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Comparison of Methods for Typical Railroad Jobs

By FRANK C. HUDSON

A COMPARISON of methods frequently aids in devising ways and means that are better than any now in use. With this in mind I have shown the more commonly used methods of handling driving-box work, and have included crown brasses and hub liners. At a later date similar comparisons may be made of other well-known back-shop operations. It is hoped that shop executives having newer and better methods will send them to the *American Machinist*, so that all may benefit. A few railroads cast the crown brasses in the driving box—some pouring the side- or hub-wear surface at the same time. The great majority, however, still machine both the box and the crown brass separately and press the brass into place. The driving boxes are machined on either a shaper, planer, or slotter, with the shaper probably having the most advocates. In machining the outside of the crown brass, however, both the shaper and lathe are widely used. A shaper method is shown in Fig. 1. The boring mill, as shown in Fig. 2, is also used for this job. In turning and shaping, regardless of the type of machine used, the crown brass is held on a mandrel having collars that clamp it by the ends. The construction varies a little in different shops but is for the most part very similar. The crown brass is held either by setscrews in the flanges of the mandrel, or the flanges are drawn together by bolts, as in Fig. 3. A similar mandrel could also be used in the lathe. The growth of the shaper method is largely due to fixtures designed by the builder of a shaper well known in railway work.

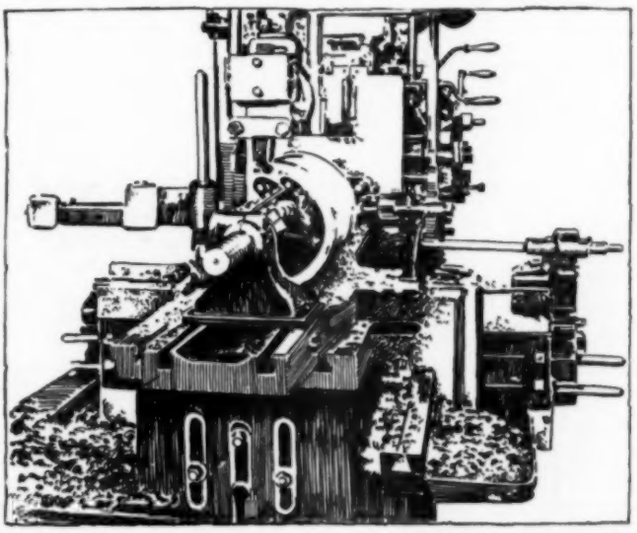
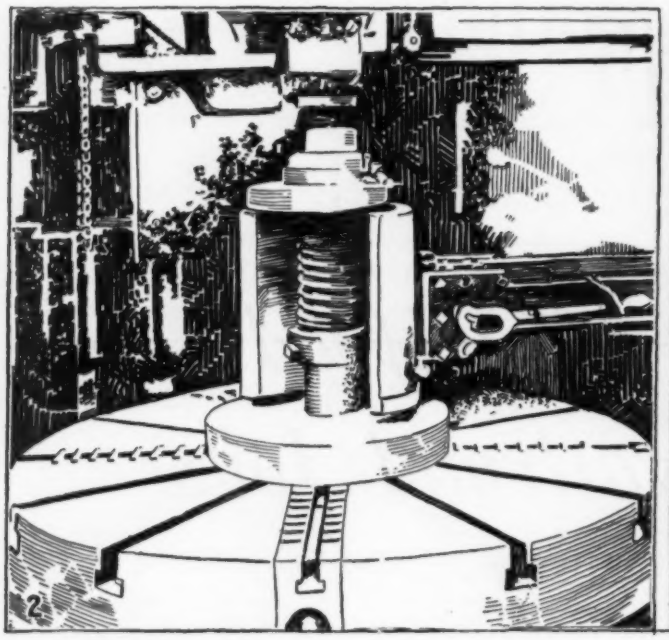


Fig. 1—Machining the outside of a crown brass on a shaper. This is a very common method, and has taken the place of turning in many shops. Its use has been largely increased by the development of special fixtures for holding the crown brass on the shaper table and revolving it automatically at the end of the shaper stroke

A double fixture, for planing two crown brasses at once is shown in Fig. 4. The ratchet wrenches on the worms are worked automatically at the end of the stroke. It is quite possible to rig a device of this kind on a shaper, using a bar carrying two tools, spaced the proper distance apart. The economy of such a method would seem to be doubtful where other types of machines were available.

Shop practice as to wear plates and hub liners, varies widely. While it is probably true that a majority of roads cast the brass wearing surface on the driving-box face after the crown brass has been forced into place, though this practice is by no means universal. Several roads cast both the crown brass and the wear plate in the driving box at the same time, while a much greater number cast a babbitt face on the box in the same way that others use brass. A few fasten a brass wear plate to the box with fillister-head screws, but this method is by no means common. Hub liners are made in a wide variety of ways. In a very few cases I have seen babbitt cast into the hub recess, but in only a few. Brass is much more common, and steel plate is perhaps even more widely used. Both are, of course, made in halves and are usually held in place by screws, well countersunk and held against coming out by various methods of peening. While hub liners and the holes for holding them in the driving-wheel hub are usually drilled before the driving wheel has been mounted on the axle, this is not always the case. Fig. 5 shows how a portable air drill has been rigged up to drill both the liner and the hub with the wheel in place. The device is clamped to the axle journal, as shown. The feed is secured by a ratchet and screw.

An exception to this method is where the hub liners



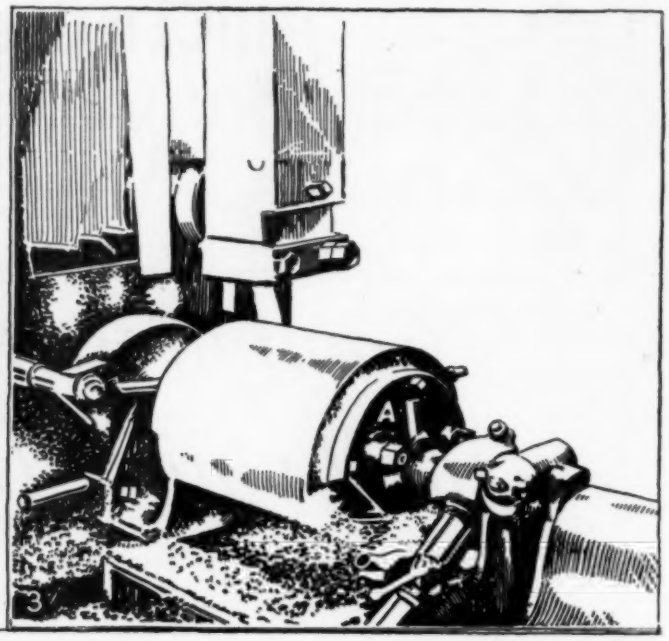


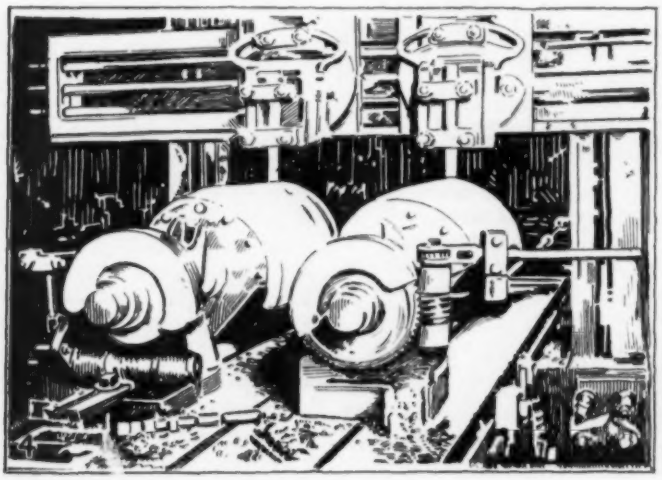
Fig. 2—Turning the crown brass on a vertical boring mill. This is a somewhat unusual practice, and its advisability depends largely on the type of machine tool available for the work. As in the shaper fixture, the crown brass is held by each end, and is so located that its outer surface is concentric with the spindle of the boring-mill table. Fig. 3—Another shaper job with a little different mandrel. In the mandrel shown, the brass is held by drawing the two flanges together by means of the through-bolt shown. This differs from the type of mandrel that has fixed flanges and setscrews projecting through them to engage the ends of the crown brass

are held in place by being welded or "tacked" to the hub, using either the arc welder or the flame torch. This practice is not common and yet some roads find it a quick and satisfactory method. The plate is held at a few points only and is intended to be easily removed by cold chisel and hammer. The axle is protected by asbestos during the welding, thus preventing any local softening due to the heat of the flame.

An outstanding hub-liner method is in use on the locomotives of the D. T. & I., or "Ford," railroad. Here the hub liners are made of a high-grade alloy steel, hardened and ground before being put in place. The results have been very satisfactory, repaying the added cost many times over in the length of service and in the reduced wear on the driving box. These liners have run for long periods without wear enough to require replacement of either the hub liner or the wear plate on the driving box. The extra cost seems to be a good investment.

One of the causes of rapid wear, and especially the scoring that takes place on hub liners made of boiler, or tank, steel, seems to be that the metal from which they are made does not make a good bearing surface, but roughs up when it runs dry. This in turn scores the brass, or babbitt, face of the driving box, and both require early replacement.

Cast-iron hub liners have also been used, but to a rather limited extent. In some cases they have been allowed to run loose, or to float, between the box and the hub of the driving wheel. Here, as with many other parts of the locomotive, the question of lubrication plays



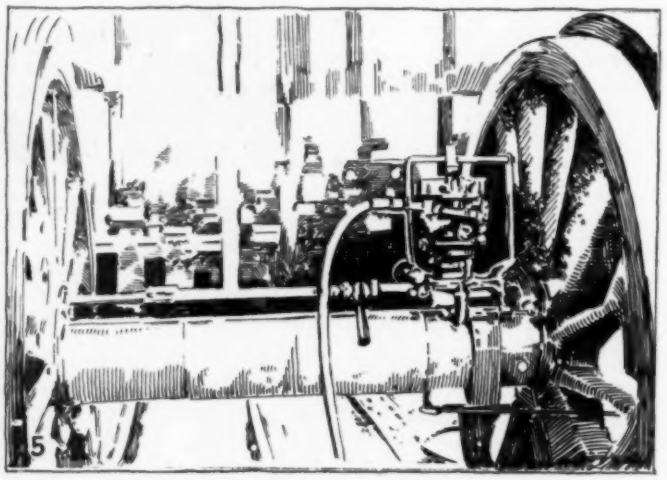


Fig. 4—Planing two crown brasses at once. This is an unusual method, because the planer is seldom used in work of this kind. The double fixture enables two brasses to be planed at the same time, both being revolved simultaneously by the ratchets shown, at the end of the stroke. Fig. 5—Drilling hub-liners in position on the driving wheel. The drilling of the wheel hub is usually done before the wheel is mounted, but this device enables the hub liner to be applied without taking the wheel off the axle. The air drill is held in place by a strap around the axle bearing

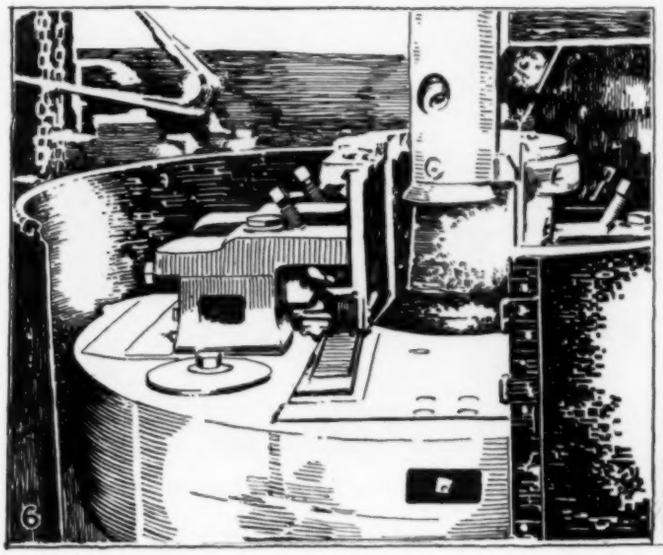


Fig. 6—Clamping driving boxes against parallels on the boring-mill table, for boring the crown brass. This is a very common method, but requires the side of the box to be machined paralleled with the shoe and wedge surfaces.

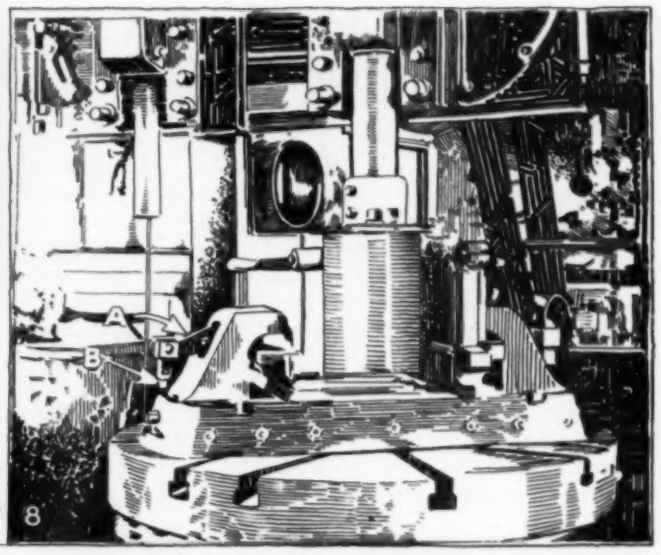


Fig. 8—Clamping the driving box by pressure against the side instead of against either flange. This method is not commonly used, but seems to have proved satisfactory in some cases

an important part. When we can devise means of thoroughly lubricating such parts as these, the cost of maintenance will be considerably reduced.

It seems to be almost universal practice to cut dovetails in the face of the driving box to retain the brass or babbitt that is cast on this surface. Some roads drill holes at an angle, or even undercut them, to act as anchors, but the dovetail method seems to be the most popular.

The use of this method is probably due to some extent to the ease with which driving boxes can be machined on the vertical boring mill, the same machine handling the driving box both in preparing it for the wear plate and for the final finishing of both the wear plate and the crown brass.

The shoe and wedge sides of the driving boxes are usually finished on the planer, setting a number of boxes in line on the table, in either single or double rows. Some form of angle plate is generally used to clamp the boxes against. When two rows of boxes are planed at once, the angle plate frequently takes the form of an open box-girder, with planed sides, but open in the middle to enable the operator to get at the clamping bolts from the inside, if necessary, although studs are generally used in such cases. Milling, while hardly used enough to be called common practice, is finding its way into some shops for this operation. In such cases there is apt to be more care exercised in securing castings that are free from sand, slag and other impurities that dull the cutting tool. For, while sandy castings are bad enough, even when a single-point tool is used, the damage to milling cutters is much more costly.

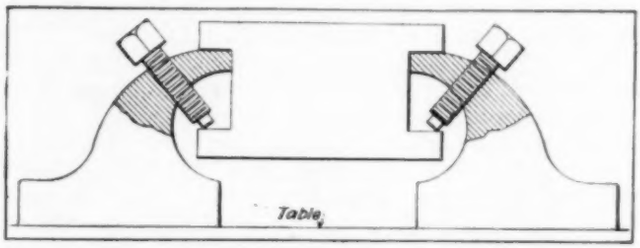


Fig. 7—This method aligns the driving box by means of the plain surface on the lower side of the upper flange. It does not require the inner side of the driving box to be machined. Where flanges are not parallel, the support must conform to the flange angle

Methods of holding driving boxes for boring the axle bearing in the crown brass, vary widely. With few exceptions the work is done on vertical boring machines, although the horizontal boring machine is sometimes used. The method of aligning the driving box, and of clamping it, varies to a considerable extent. The aligning and holding must both be done by the shoe and wedge surfaces, which have been previously machined.

Two Methods of Alignment

The method of aligning can perhaps be divided into two classes: In one the lower face of the driving box is used as in Fig. 6 and in the other, as shown in Fig. 7, the under side of the upper flange is used.

In the first case, the box rests on parallels that raise it from the boring-mill table, and it is clamped against these parallels, either by angular screws, as in Fig. 6, or by clamps. The screws shown are carried in sliding arms, the ends of which bear against the planed side of the box. The table, of course, has a hole in the center to allow the end of the bar and the chips to pass through.

In the other method the box is supported by the under side of the upper flange, while screws on each side hold it in place by bearing against the opposite flange. This method insures the bore of the crown brass being square with the shoe and wedge surfaces without the necessity of finishing the outsides of the driving box accurately. Where the flanges are planed with a double taper, the upper surface of the support is shaped to correspond.

A third method, used rather infrequently, is shown in Fig. 8. Here the driving box rests on parallels, as in the first method, but instead of being clamped by either of the flanges, it is held by the shoe and wedge surfaces.

The information desk in plants aspiring to be something should be what ordinarily it is not—a desk handled by a responsible, well-paid, well-informed man or woman who knows the job.

Cutting a Wormwheel at the Top of Mount Wilson

By John Homewood

STELLAR photography requires that the object being photographed remain fixed, so to speak, with respect to the camera. The 100-in. Hooker reflecting telescope shown in Fig. 1, plays the rôle of a large camera, and to comply with the conditions stated above, its movements must be controlled by the most exacting means.

The great globular star-cluster in Hercules, calculated to be 36,000 light-years away, is shown in Fig. 2. Here we have four pictures taken with a 60-in. telescope, each increasing one magnitude on each exposure. The faintest star visible to the naked eye is in the sixth magnitude and the brightest one is in the first magnitude. These pictures were taken with exposures of 6, 15, 37½, and 94 minutes, respectively. It is obvious that any recording mechanism that will move the telescope, in order to compensate for the rotation of the earth on its axis, must possess the very highest degree of uniformity in its movement.

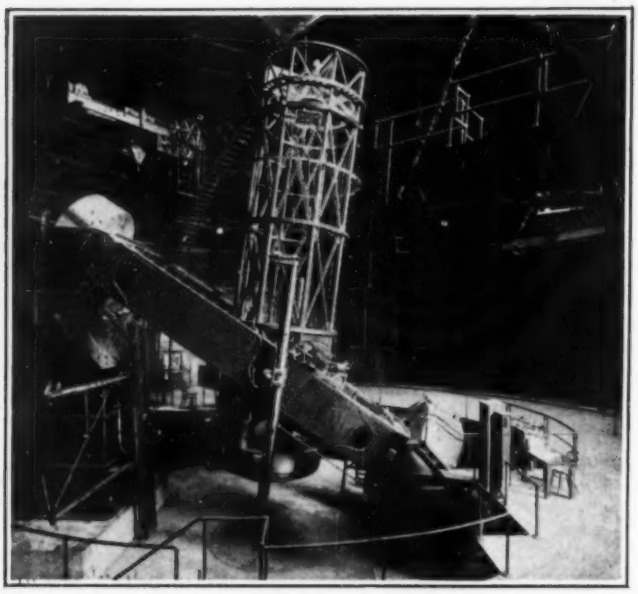


Fig. 1—Reflecting telescope on the top of Mount Wilson

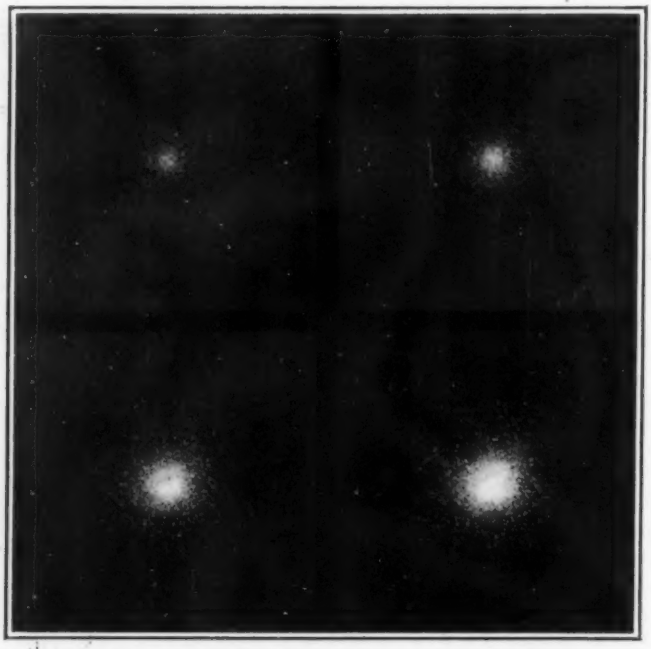


Fig. 2—Star-cluster in Hercules made in different times of exposure

Fig. 3—Gashing the 1,440-tooth wormwheel

It is the degree of accuracy of the massive 1,440-tooth cast-iron wormwheel, made in two parts, that is the deciding factor in this work. The only assurance that the wormwheel would be correctly machined, was to cut the teeth in position, on the mountain-top. The wormwheel operates parts of the telescope weighing almost one hundred tons, and in order to reduce the friction on the main bearings of the polar-axis, there are provided two large, hollow steel drums floating in mercury. The wormwheel was turned to size before it was taken up the mountain, and after being installed in place, the difficult task of finishing was done as follows:

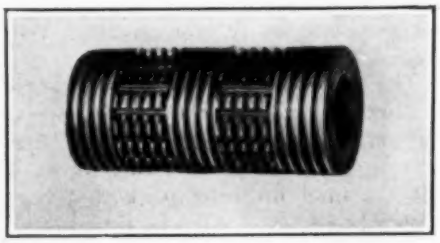


Fig. 4—Sectional hob for finishing the teeth

It was provided with a highly polished edge for the purpose of scribing lines, as will be referred to later. On the end of the polar-axis was fastened a circle graduated in five-minute divisions. Graduations were read through a microscope by an observer, while another worker was stationed at the edge of the wheel, where a straight-edge was installed for the purpose of scribing very fine lines. After the lines were scribed another microscope was installed, as shown in Fig. 3, and the lines were checked and double checked.

Using the outer lines as guides, the wheel was moved the required amount for each tooth by the handwheel shown under the microscope and the clamp. The clamp was fastened and unfastened as occasion required. The wheel was gashed twice around, the gashing cutter being held on an arbor driven by worm drive from a motor.

After the teeth were gashed, a sectional hob of $\frac{7}{16}$-in. circular pitch, 5 in. in diameter and 18 in. long, was substituted for the single cutter. Five of the hob sections are shown in Fig. 4. The cutting sections were made a few thousandths larger than the blank sections. After the hobbing operation had been completed, the hob was replaced with a worm blank which was "run in" by using jeweler's rouge and oil as a polishing medium.

Approximating an Ellipse by Circular Arcs

By Carl G. Barth

The three methods given all make use of the mean radius of curvature as determined graphically — Four, three and two arcs per quadrant, respectively, are employed

FIFTY years ago, the writer devised one of the many methods of approximating an ellipse of moderate eccentricity by two circular arcs in each quadrant. Recently he became interested again in the general subject of approximating an ellipse by circular arcs and, after investigating all the various methods he could find, he concluded that it ought to be possible to improve on even the best of them. Feeling confident that his efforts to do so have been successful, he wishes through this article to give publicity to the results obtained.

The three methods to be described were all developed under the condition that as many points as possible on any approximation to an ellipse should, obviously, be true points of the ellipse, so that the method employed would be convincing as an approximation worthy of the name.

As in well known, the radius of curvature of an ellipse at each of the extremities of the major axis is $r = \frac{b^2}{a}$ and of the minor axis, $R = \frac{a^2}{b}$, when

a = length of semi-major axis
b = length of semi-minor axis

The mean proportional of R and r is therefore

$$R_m = \sqrt{Rr} = \sqrt{\frac{a^2}{b} \times \frac{b^2}{a}} = \sqrt{ab}$$

That is, equal to the mean proportional of the two semi-axes. This mean radius of curvature has been employed in several previous methods for approximating an ellipse, and is also, directly or indirectly, made use of in the following methods. These methods also make use of one of the simplest and best-known methods for determining true points on an ellipse, namely the one illustrated in Fig. 1. In this figure is also illustrated the common method of drawing a tangent CD to an ellipse at any point C. Tangent DC_1 is first drawn to the arc of the circle, whose radius is $a\ (= OA)$, at point C_1 from which point C on the ellipse was obtained, in the self-evident manner shown.

The essentially new feature of the methods to be described, is the use made of the discovery of a simple way of locating that point on an ellipse at which the radius of curvature is the mean radius of curvature referred to above, namely $R_m = \sqrt{ab}$. This method of construction is shown in Fig. 2, in which the mean radius was determined to be AV, which then was laid off as AW on the perpendicular AE at the extremity of the major axis. The radial line OW is utilized (as were the several radial lines in Fig. 1) to locate that point C on the ellipse at which the radius of curvature is $R_m = \sqrt{ab} = AW = AV$. This length, when laid off as CH on the normal at the point C (that is, the perpendicular to the tangent CD), gives H as the center of the radius of curvature of the osculating circle to the ellipse at the point C. A substantial arc of this circle has also been

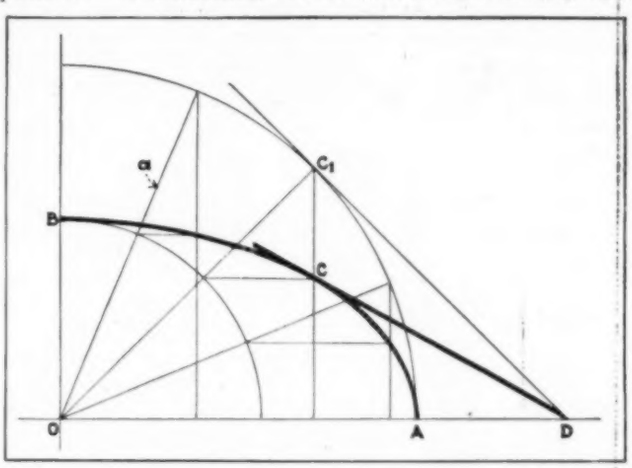


Fig. 1—The true points of an ellipse may be obtained from the major- and minor-axis circles as shown. The tangent at any point is obtained by first drawing the tangent to the major-axis circle at C, thus locating, in the example, the point D, from which the tangent to the ellipse is drawn

drawn in the figure to show how closely it coincides with the ellipse itself for a very short distance each side of C, but how rapidly it falls off inside of the ellipse toward the minor axis and increases its deviation outside the ellipse toward the major axis. Evidently, an arc described with a suitably selected radius longer than HC (about center K on this normal) must conform quite closely to the true ellipse between point C and some point M near to this on the side of the minor axis. Similarly an arc described with a radius somewhat shorter than HC (about center L) must conform quite closely to the true ellipse between point C and some point N near to it on the side of the major axis.

The arguments advanced above are utilized in the construction of the approximate elliptic quadrant shown in Fig. 3, which consists of four circular arcs between five points on the true ellipse (three besides the extremities

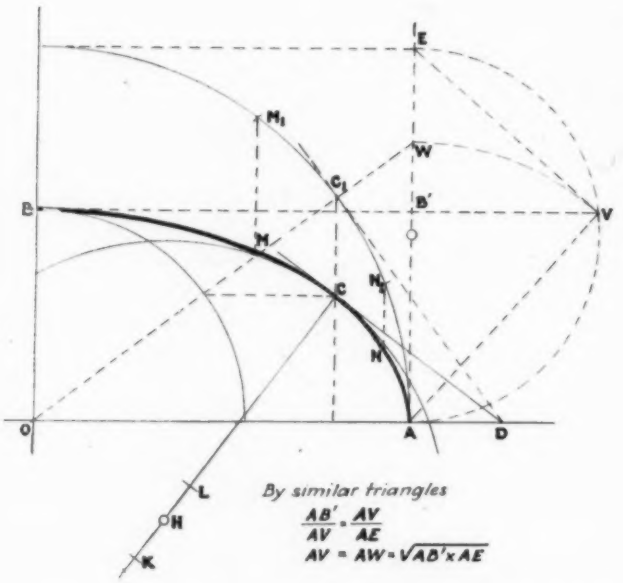


Fig. 2—The mean radius of curvature AV is found graphically, and is located on the ellipse as HC in the manner shown. Centers K and L, selected arbitrarily, give radii whose arcs more closely approximate the curvature of the ellipse on either side of C, the point of mean radius

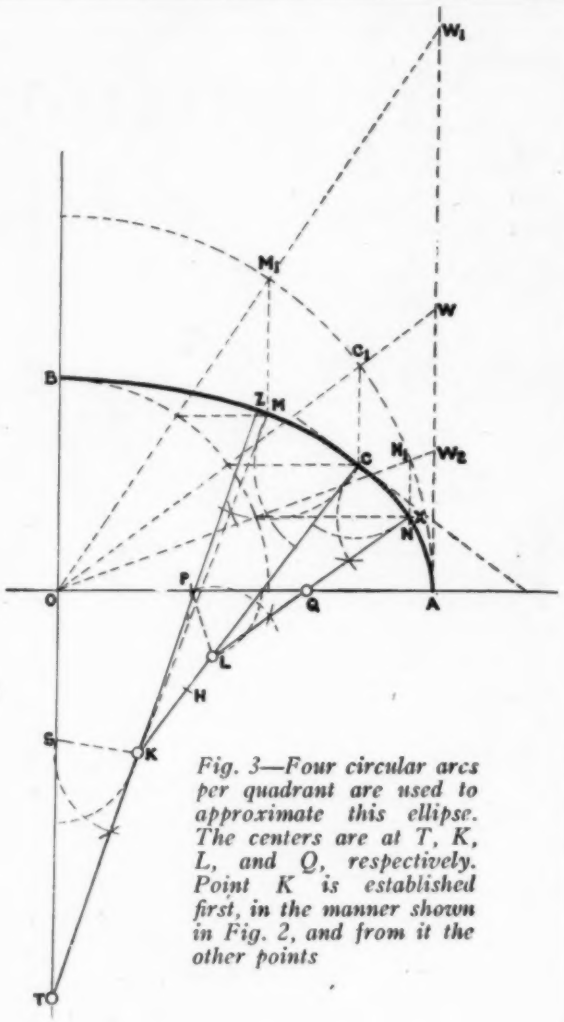


Fig. 3—Four circular arcs per quadrant are used to approximate this ellipse. The centers are at T, K, L, and Q, respectively. Point K is established first, in the manner shown in Fig. 2, and from it the other points

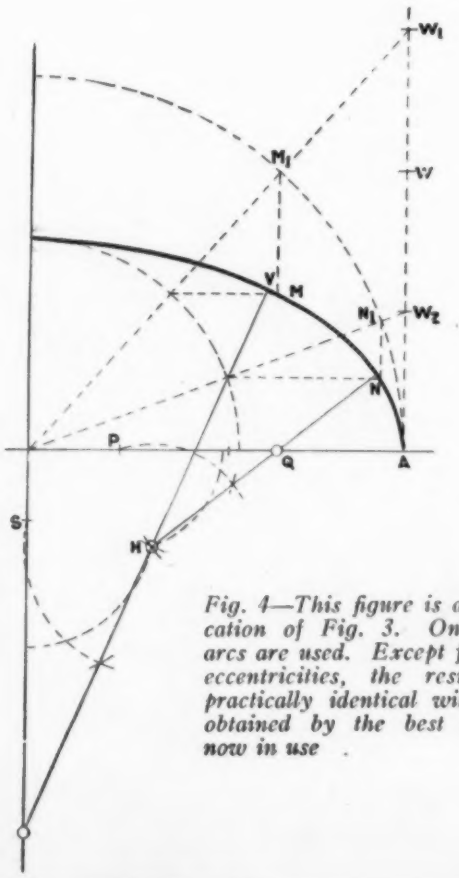


Fig. 4—This figure is a modification of Fig. 3. Only three arcs are used. Except for large eccentricities, the results are practically identical with those obtained by the best methods now in use

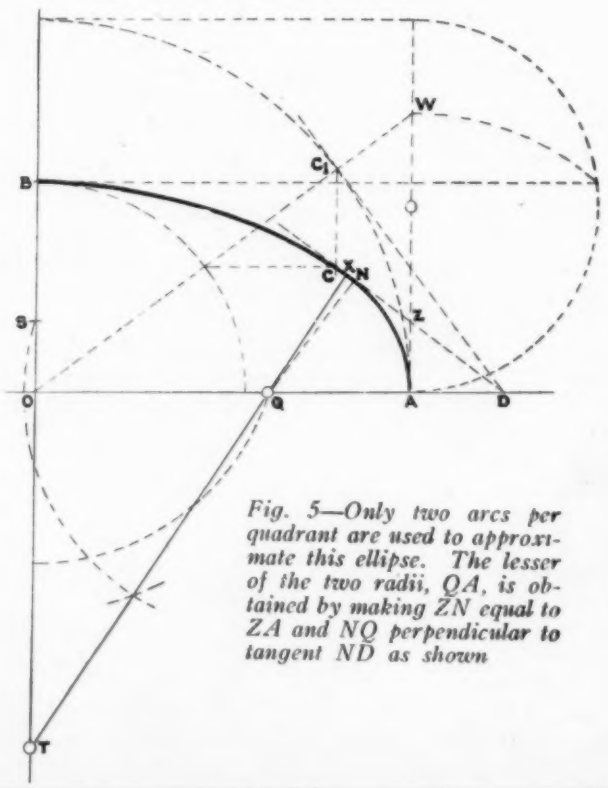


Fig. 5—Only two arcs per quadrant are used to approximate this ellipse. The lesser of the two radii, QA, is obtained by making ZN equal to ZA and NQ perpendicular to tangent ND as shown

of its axes), and which also has one tangent in common with the true ellipse, besides those at the extremities of its axes.

First the three points C, M and N are located on the true ellipse by means of the radial lines OW, OW_1 and OW_2, drawn respectively to the points W, W_1 and W_2 on the perpendicular at the extremity of the major axis. These points are located by laying off the distance $AW = R_m = \sqrt{ab}$, as was done in Fig. 2, and then AW_1 equal to $2\,AW$ and AW_2 equal to $\frac{1}{2}\,AW$. Next, after the normal CK is erected at the point C, as in Fig. 2, the line MK is drawn equal to CK by making angle CMK equal to angle MCK. The distance $MK\ (= CK)$ is then laid off as BS on the minor axis extended and point T on this located so as to make TS equal to TK, by making angle SKT equal to angle KST. Finally, TK is extended to Z, the arc BZ drawn about T as center, and the arc ZC about K as center.

Similarly, by making angle CNL equal to angle NCL the point L is located on the normal CK, after which $LC\ (= LN)$ is laid off as AP on the major axis. The angle PLQ is made equal to angle LPQ and line LQ extended to X*. The approximation is completed by drawing the arc CX about L as center and the arc AX about Q as center.

A modification of the method just described consists in getting a close equivalent for each of the two intermediate radii KC and LC, and thus dispensing with the two points M and N. It has been found that an exceedingly close equivalent to LC, the shorter of the two intermediate radii is given by the formula $R_{m1} = \sqrt{bR_m} = \sqrt{b\sqrt{ab}}$, while for the larger radius a very fair substitute is, $R_{m2} = \sqrt{aR_m} = \sqrt{a\sqrt{ab}}$. The somewhat longer expression, $R_{m2} = \sqrt{AR_m} + \frac{1}{2}\left[\sqrt{aR_m} - R_m\right]$ is still better, but it need only be used in case of large eccentricities.

In Fig. 4 is shown a construction with only three arcs, which, except for large eccentricities, gives approximations that are practically identical with those of the best methods the writer has come across, and which for large eccentricities gives even slightly better results. In this figure the single intermediate radius is $R_m = \sqrt{ab}$ with its center H, located from the two points M and N on the true ellipse. These points are obtained by means of radial lines OW_1 and OW_2 drawn to the points W_1 and W_2 on the perpendicular AW at the extremity of the major axis after first locating these points by making $AW_1 = \frac{3}{2}\,AW = \frac{3}{2}\sqrt{ab}$, and $AW_2 = \frac{1}{2}\,AW = \frac{1}{2}\sqrt{ab}$. In Fig. 5 is shown a method of using two arcs only. This gives far better results when applied to fairly large eccentricities than any other similar method that has come to the writer's notice. The initial procedure is the same as for the two previous methods described. The lesser of the two radii $QA\ (= QX)$ is obtained by making ZN equal to ZA and NQ perpendicular to the tangent ND as shown.

*For the particular ratio of the two axes of this example, the point X fell so close to the original point N that the difference, if any, did not show up.

Department Heads—and Underlings

By John R. Godfrey

"PICK your department heads right, Jim, and you can forget the rest of the crew. I never deal with anyone but the heads of departments. No use bothering with the underlings." 'Twas John Buckley, head of a great motor company that had made itself known all over motordom. "Jim" was James Hurley, also well known in a similar line, and an old-time pal of Buckley's. And, in addition to being well known, he stood high with his men, which means a lot.

"Sounds easy, Jack. And we've all got to admit you've built up a great organization. But I'm not dead sure you've got the answer—not by a long shot."

Jim Buckley wasn't used to having his ideas criticized. Few knew him well enough to undertake the job. For, like many a big man, he had, unconsciously perhaps, surrounded himself with a lot of "yessers"—and it's mighty easy to get to thinking you are a lot nearer being infallible than you are, or anyone else is, for that matter.

"Just what do you mean, Jim?"

"Well, Jack, I'm going to be brutally frank with you, because you need it. You're kidding yourself about your heads of departments being the whole works. And you don't always pick 'em, right or otherwise. They are often forced on you, or you get 'em accidentally at times. We all do. And when you let it be known that you haven't any time for anyone but department heads, you're serving notice on a lot of good men to hunt another job. And the best ones do it—to your loss."

"But my department heads keep me in touch with all the new things—"

"And generally let you think all the good ideas are the product of their massive brains, even if they don't tell you so in so many words. How many of them ever tell you of the good suggestions that come from the men under them?"

"Not many I'll admit, Jim. And I don't believe they do either. I've picked a lot of outstanding men—"

"Kidding yourself again, Jack. But suppose you have. Where is your next crop of outstanding men coming from if all your stars should quit or drop dead? You ought to really know your *under* men, too, Jack. There's a lot more real brains there than you may realize. And they aren't getting any happier or any more loyal by being snubbed."

"But, Jim—"

"Now, Jack, I've got started and I'm going to cut in again and get a few things off my chest. Do you remember when you and me were at the old Brown shop, long years ago?"

"You bet I do, Jim."

"And do you remember the old super, Hank Howard?"

"I'll never forget him. Why dern his hide—"

"Never mind that now, Jack. You remember how he came to be super? He was the only man lying around loose when the old super died. So he was picked as the new head. One of the outstanding men you're talking

about. And old man Brown came to think he really knew the job. Wouldn't talk to anyone but Hank. And how long would Hank have lasted if we hadn't kept the shop running for him? Lord! Jack, he didn't know the first damn thing about running a shop. He didn't have any particular policy—and he didn't stick to what he had. He could pull highbrow language on the old man, and he stood in with the so-called society of the old town—which we didn't. But if we hadn't kept things moving he'd have been in a nice mess. All he knew was how to cop our ideas and make the old man think they were his."

"Didn't he though, Jim. Why the old scoundrel couldn't have held his job but for us and the rest of the boys. Of course he picked up a lot of knowledge and got to thinking he'd always known it. He kowtowed and yessed the old man till he thought Hank was all he pretended to be."

"Yes, Jack, he was Brown's *outstanding* man—head of his department. And what happened? He stole our ideas without a thank-you, and the old man never knew they were ours. He got so that he could swing the job after a fashion and we couldn't get a square deal. Old Brown didn't even know we were on the map so far as we could tell. And where is the old man's business now, Jack?"

"Busted, Jim. Busted—and served him right."

"Well, Jack, hadn't you better take that lesson home and chew it over a bit?"

"What's that? Think I'm like old man Brown? You're crazy, Jim. Ate something that didn't agree with you."

"Not so crazy as you'd like to think, Jack. You've got several Hank Howards putting it over on you in the same way. I could name 'em—but I won't. And as long as you hug the idea that all the brains of any department are tied up in the cranium of any one man, you're inviting the same kind of trouble."

"But I can't bother with the whole crew, Jim—"

Don't Forget the Men

"It isn't a bother, Jack—it's part of your job. For, after the men who are really responsible for results find that you don't even know they're on the payroll, you're heading for trouble. Did you ever hear a freight train conductor strut around and tell how many cars he'd pulled that day? Never thinks the engineer had anything to do with it. He's the *outstanding* man you're blowing about.

"And say, Jack, do you ever hand out any commendation to the whole department that does a good job, or do you just send a nice, oily letter to the outstanding man and let him show it to the others? You know what kind of a thrill they get when you write that you commend Mr. Jones highly for the splendid work he did in the salvage department last month. While the boys who really schemed out the way to make the showing aren't even among the 'also rans'."

"How do you know all this about my plant, anyhow, Jim? Looks like you've been snoopin', as we used to say."

"Don't have to snoop, Jack. Everybody in town knows it. It's like the time old man Brown gave Hank Howard the gold watch for getting that order out on time. Do you remember it, Jack?"

"I'll say I do, Jim.

"And how fighting mad we both were over it? You know damn well he never would have got it out except for us. The size of it had him completely buffaloed and he was plumb loco over the whole job. We pulled him out—and he got the watch and the glory—while the old man thought we were just a couple of excrescences on the overhead. If Brown had been able to see anybody but Hank Howard, and had made it interesting for us, we'd have stayed, and the chances are the place wouldn't have been sold out by the sheriff later."

"Are you by any chance hinting that I'm likely to go the same way, Jim?"

"Probably not, Jack, though stranger things have happened. If you keep on ignoring the men who really do the work, even if they don't wear the titles, and hand all your bouquets to your *outstanding* men—the men who are really doing the job without your knowing it. will get sick of 'all work and no recognition,' and come to work for me."

"Flattering yourself a bit, eh, Jim?"

"Not specially, Jack. I've got several already."

"The devil you have. I sure never thought you'd hire men away from me, Jim."

He Gets a Chance

"I haven't—and I wouldn't. But all the same I've got several men who used to work for you. And I think they're a damn sight better men than some you have left. These are men you wouldn't bother to see. You'd rather see your *outstanding* men Jack. Well, I'll match these chaps that you never knew were on the payroll, against almost any department head you've got. Some of 'em wouldn't be outstanding enough to make a shadow in our place. No, Jack, I didn't hire any men away from you. But when a good man comes and tell me he's quit your shop because there wasn't any chance of advancement, and wants to take a whack in my plant, he gets the chance unless I know some good reason why not."

Jack was worried, more than he would admit.

"I know it's none of my business in a way, Jim, but I'd kinder like to know who you've hired that comes under that head. Do you mind telling me?"

"Of course not. One of them is Joe Haines who used to be in your publicity department. You remember that beautiful job your department did about two years ago? That booklet that had us all envious of your outfit? Well, that whole idea was Joe's. He took it to his boss and sold him on the idea. Jackson took it up with you and you had sense enough to see that it was a peach of a plan. Joe did the work—and Jackson copped the credit. You patted him on the back and boosted his salary and spilled the glad tidings all over motordom that your man Jackson was the real cheese when it came to publicity."

"Well, how was I to know—and do you know it's true?"

"I'm pretty sure of it because Joe has just shown me a new plan that will make yours look like a last year's almanac. And I haven't noticed that Jackson has had any new ideas to spring since the one I refer to. If you had talked the thing over with several of the boys in the publicity department, Jackson wouldn't have dared claim the idea as his own.

"It's an unwritten law in our plant that any man caught copping credit for anything is pretty apt to be hunting another job. I encourage the men to give credit to the men under them. If one of our foremen claims too many good ideas I'm suspicious right away. I don't pin all the roses on the head of the department. Some of 'em go down the line. But don't blame Jackson too much, Jack. Your system led him into temptation, you know."

Automotive Production

Glimpses of Mack Production

By S. J. KOSHKIN
Associate Professor of Machine Design, Cornell University

Heat-treatment and laboratory tests at the New Brunswick plant

THE plan of the heat-treating department of the New Brunswick Plant of the International Motors Company is shown in Figs. 23 and 24. The department has six normalizing furnaces, four annealing furnaces and sixteen carburizing furnaces. There are also two electric furnaces, one forge furnace and four lead baths for shaft hardening, a steam hammer and other equipment of a heat-treating department, such as quenching and pickling tanks. There are also three gear quenching machines. The heat of all the furnaces is controlled from the pyrometer room shown in Fig. 25. The materials are handled by many air-operated hoists such as the one shown in Fig. 26, and by a monorail system with carriers. Electric lifting trucks are much used for communications with other departments.

The hearths of the normalizing, annealing and carbonizing furnaces are 3 ft. or 3 ft. 9 in. wide and 7 ft. long; the height is 18 in. near the wall. The furnaces are of the open-fire oil-burning type. The electric furnaces are of the portable type. The hearth has an effective heating zone 18x168 in. The furnace is of the continuous type, the hearth being formed by a series of heat-resisting metal rolls. Each roll is fitted with a sprocket on one end and is driven by chain from a motor drive. The motor operates through a fixed reduction gear and a change-gear mechanism, permitting a variation of from 20 min. to 1 hr. in the time taken for the work to travel through the furnace. The heating elements are located under the arch on ledges projecting from the side walls, and in the bottom under the roller hearth. They are so distributed as to effect proper heating conditions with a temperature generally ranging between 1,400 to 1,600 deg. Fahrenheit.

The heating elements of the furnace are divided into two control zones. The one in the charging end has a connected load of about 54 kw. and is automatically operated by a control instrument of the potentiometer type. The heating element in the zone on the discharge end has a connected load of approximately 36 kw., controlled automatically and recorded by a potentiometer-type controlling recorder. All the heating elements are of rugged nickel-chromium ribbon resistors and are protected from scale or dirt by plates of heat-resisting alloy.

The furnace is equipped with temperature control panels, complete with solenoid contactor-switches, relays, main switch fuses, thermocouples, thermocouple leads, and a watt-hour meter. The rough material comes on electric lift trucks from the rough stores department in corrugated boxes, 2 ft. x 3 ft. x 3 ft. 6 in., each carrying a tag giving full information about the required heat-treatment. The material is kept for about 2½ to 3 hr. at a temperature of 1,600 deg. F., and is then put on trucks and cooled for about 3 hr. 10 per cent is then inspected for hardness. In the pickling department the

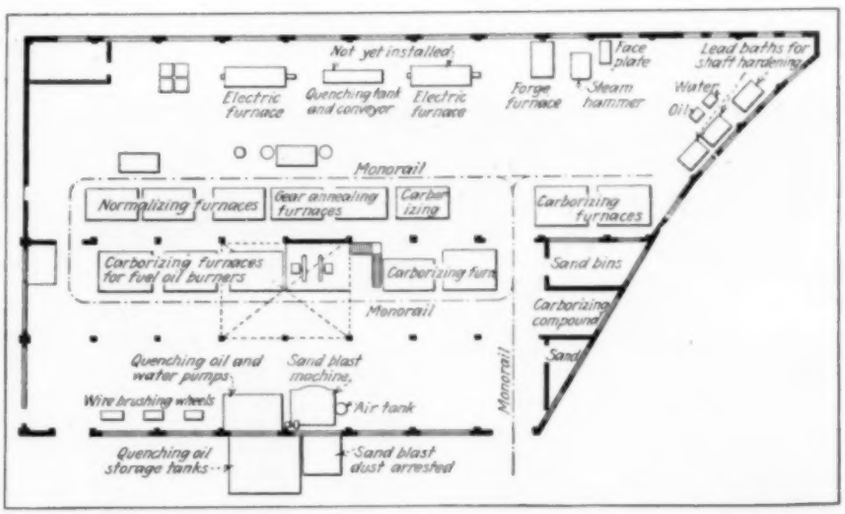


Fig. 23—Plan of heat-treating department. Most of the furnaces are of the open-fire, oil-burning type. They are hooded with sheet iron to reduce the room temperature. The electric furnace is of the continuous type and has two control zones, one at the charging and the other at the discharge end

The third and concluding article.

Automotive Production

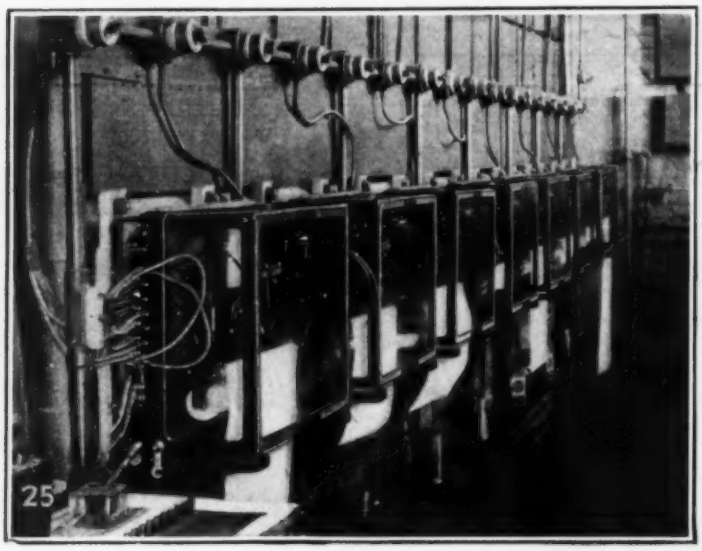


Fig. 25 — Control room equipped with double-point recorders. An accurate control of the heat (automatic with the electric furnaces) is a very prominent feature of the department

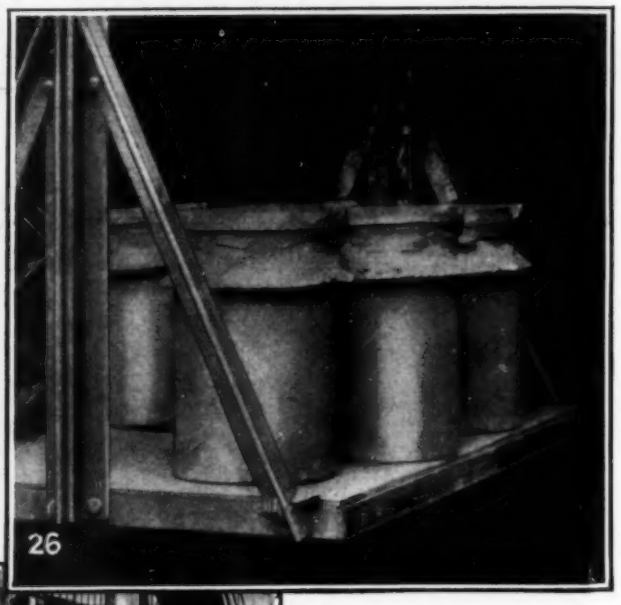


Fig. 26 — Carrier with pots to go into the carburizing furnaces. These carriers are suspended from the rail of a monorail system running throughout the heat-treating department

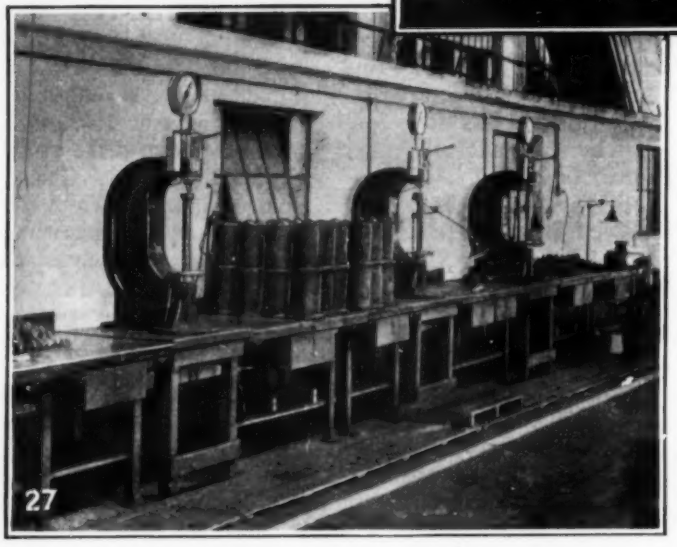


Fig. 27—Testing machine for indentation hardness on the Brinell principle. Many of these machines for measuring the resistance to penetration and deformation are used by inspectors throughout the plant

Fig. 28—A thorough inspection is given to all heat-treated pieces that must conform to the exacting specifications necessitated by the high class of work done. Note the roller conveyor to carry the trays

Automotive Production

Fig. 29 — Electric truck with heat-treated spline shafts on its way to the inspection department. Many of these lift-trucks, carrying material in corrugated boxes placed on platforms, are sed throughout the plant.

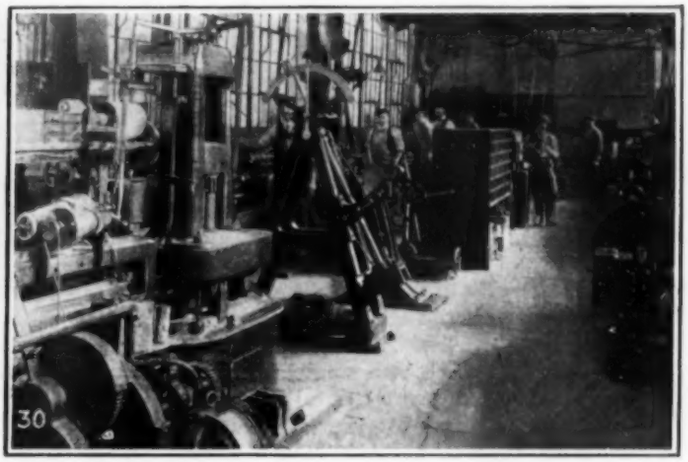


Fig. 30—A corner of the physical testing laboratory in which all the important properties of the materials are checked

material is kept for from 7½ to 8 hr. in vats containing a 5-per-cent solution of sulphuric acid for removing the scale formed during normalizing.

The pickling liquid is transferred by suction to the next tank and is replaced by water (pure or with some soda) and the material is washed for about 3 hr. After this it is put into corrugated boxes and delivered on electric lift-trucks to the machine shop.

If the rough material is to be hardened, the heat is brought above the critical temperature—say 1,500 deg. F. —then quenched in water at ordinary temperature, and after this it is reheated to a drawing temperature lower than the critical (say 1,250 deg. F.) to get the desired hardness.

If, for example, a chrome-nickel steel is to be treated, it is first normalized at 1,600 deg. F. for 3 to 3½ hr., then cooled in air about 3 hr., reheated to a drawing temperature of 1,250 deg. F., and cooled in the furnace to 600 deg. F. then cooled in air. The Brinell inspection for hardness (see Fig. 30) is given to all such alloy steels.

The important criterion for transmission gears, which constitute one of the chief products of the plant, is resistance to wear, and they must show a Brinell hardness of from 512 to 560. The material must have good forging and machining qualities and must respond to a good commercial range of heat-treatment.

The heat-treatment of the finished gears consists of quenching in oil from a temperature of 1,500 to 1,540 deg. F., followed by tempering in oil at from 375 to 425 deg. F. Gears so treated will show a Brinell hardness of from 512 to 560, or a scleroscope hardness of from 72 to 80. Over 560 Brinell, danger is encountered due to low shock-resisting properties; under 512 Brinell, trouble is experienced due to wear and surface fatigue of the teeth.

The proper annealing temperature depends on the kind of steel; for carbon steel, for example it varies from 1,450 to 1,600 deg. F. Different methods are used for the following four groups of steels: High-speed, alloy, tool or crucible, and high-carbon machinery steel.

The carburizing of small pieces packed in 8-in. pots, such as are shown on Fig. 26, lasts about 24 hr. The furnace temperature gradually increases from 1,580 to 1,700 deg. F. during 4 hr., then remains at its maximum for 1 hr., and is gradually decreased from 1,700 to 1,580 deg. F. and held for 19 hr. Jack shafts, rear axle shafts, and other long articles, that are not carburized, are treated in the rectangular lead furnaces shown in Fig.

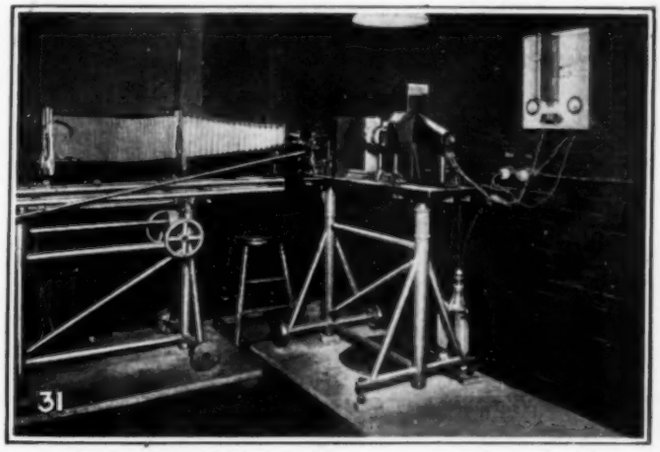


Fig. 31—The microscopic laboratory is thoroughly equipped with modern appliances for making photo-micrographs of all sizes.

Fig. 32—The chemical laboratory. Here analyses are made of all supplies, not only those of metal, but of paints, oils, gasoline and other raw products that are purchased for use in the plant

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26. They are heated to 1,450 deg. F. for about 2 hr., quenched in oil and cooled, drawn to 650 to 750 deg. F. for 1 hr., and finally quenched in water. Lead baths can be used for temperatures as high as 1,800 deg. F. and as low as 600 deg. F. If lower temperatures are desired, say to 400 deg. F., some tin must be added to the lead.

After heat-treatment, the articles are washed in kerosene, then in boiling water containing soda for from 5 to 10 min., then they are carried to the respective inspection departments (Figs. 27, 28 and 29). The larger gears are inspected for warpage by testing the squareness of the gear face with the teeth by an indicator, and then file-tested for hardness. The cleaning of certain heat-treated articles is done in a sandblasting cabinet.

The equipment of the physical laboratory shown in Fig. 30, in which some of the outgoing and all of the incoming materials are tested, is as follows: A wear-testing machine. It tests metals for wear and the coefficient of friction of oils. A torsion testing machine of

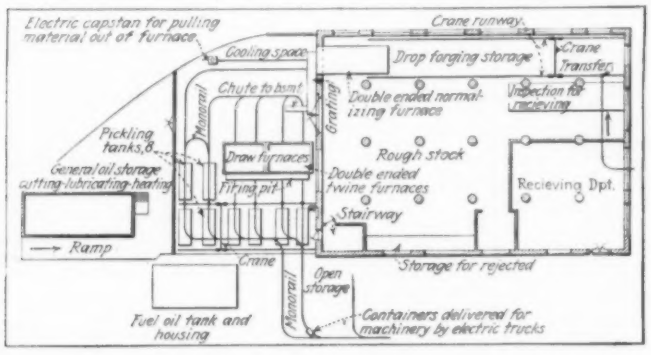


Fig. 24—Plan of the proposed arrangement of pickling tanks and extension to heat-treating department. Note that the monorail system is extensively used. The materials are also handled by many air-operated hoists and by other means

232,000-lb. capacity, motor-driven. A tensile testing machine of 200,000-lb. capacity. A small tensile testing machine up to 100,000-lb. capacity. Two bearing testing machines for breakdown tests. An impact testing machine for aluminum. An Azod (impact) testing machine. A fatigue testing machine for showing the endurance limit of the material under many millions of repeated stress reversals. An electric furnace for laboratory use. (It has automatic control up to 1,800 deg. F.) A Brinell machine for measuring the resistance to penetration and deformation. A hardness tester (with diamond) to measure indentation hardness. A scleroscope for measuring rebounding hardness.

In the tensile machines, the four important properties of the material can be determined, namely: yield point, ultimate strength, elongation and contraction.

The microscopic laboratory, Fig. 31, is equipped with modern Zeiss and Bausch & Lomb optical benches, and contains a very complete darkroom, for the development and enlargement of photo-micrographs, etc. A considerable portion of the forgings and bar stock is subjected to microscopic and macroscopic examinations.

The chemical laboratory, Fig. 32, is equipped to handle metallurgical, as well as miscellaneous analyses, such as pertain to paints, oils and gasoline, and other raw products used in a plant of this kind.

Simplified Wrench Markings

THROUGH the courtesy of J. H. Williams & Co., a list is printed of standard bolts and nuts corresponding to the width of opening of the wrench. The American Engineering Standards Committee has specified that wrenches shall be marked only with the size of opening, that is, the width across the flats of the bolt or nut they fit. This action was necessary because the recent addition of the new American Standard bolt and nut sizes, necessitating additional combinations of wrench openings, made it no longer feasible to stamp wrenches with all the available bolt and nut sizes. The principal members of the drop-forged wrench industry have adopted this recommendation and all new wrenches are so marked.

*Openings as stamped	Nominal Size of Bolt or Screw				
	U. S. Std. Nuts	U. S. Hex-Head Cap Screws	S.A.E. Std. Nuts and Cap Screws	American Std. Nuts	American Std. Hex-Head Cap Screw
5/16	1/8	1/8			
3/8		3/16			
13/32	3/16				
7/16		1/4	1/4	1/4	1/4
1/2	1/4	5/16	5/16		5/16
9/16		3/8	3/8	5/16	3/8
19/32	5/16				
5/8		7/16	7/16	3/8	7/16
11/16	3/8				
3/4		1/2	1/2	7/16	1/2
25/32	7/16				
13/16		9/16		1/2	9/16
7/8	1/2	5/8	9/16	9/16	5/8
15/16				5/8	
31/32	9/16				
1		3/4	11/16		3/4
1- 1/16	5/8		3/4		
1- 1/8		7/8		3/4	7/8
1- 1/4	3/4	1	7/8		
1- 5/16				7/8	1
1- 3/8		1-1/8			
1- 7/16	7/8		1		
1- 1/2		1-1/4		1	1-1/8
1- 5/8	1	1-3/8	1-1/8		
1-11/16				1-1/8	1-1/4
1-13/16	1-1/8		1- 1/4		
1- 7/8				1-1/4	
2	1-1/4		1- 3/8		
2- 3/16	1-3/8		1- 1/2		
2- 1/4				1-1/2	
2- 3/8	1-1/2				
2- 9/16	1-5/8				
2- 5/8				1- 3/4	
2- 3/4	1-3/4				
2-15/16	1-7/8			3	
3				2	
3- 1/8	2				
3- 3/8				2-1/4	
3- 1/2	2-1/4				
3- 3/4				2-1/2	
3- 7/8	2-1/2				
4- 1/8				2-3/4	
4- 1/4	2-3/4				
4- 1/2				3	
4- 5/8	3				
5	3-1/4				
5- 3/8	3-1/2				
5- 3/4	3-3/4				
6- 1/8	4				
6- 7/8	4-1/2				
7- 5/8	5				

* Proper clearance is provided by the manufacturer.

New Theories in Tempering Steel

By Alfred Heller

Analysis of the color method of tempering steels, and the effect of time variations on the color and hardness of the metal—Control of the temperature by fusible alloys—Proper drawing temperatures

THE color method of tempering is still widely used, and it is safe to say that in most of the smaller plants tools are drawn to color or to the melting point of solder. Even in large and well-equipped plants, tools are often drawn to color because of the convenience and speed of this method. Temper colors have never been carefully investigated, but it is generally known that they are not accurate. It is important, therefore, to know just how accurate temper colors are, and what the conditions are that effect their appearance. Some 180 samples of steel were prepared from 0.95 carbon tool steel ¼x½x0.022 in. in size, hardened at 1,400 deg. F., and then ground and polished. A steel block 4½x 4½x4½ in. was prepared for applying the tempering heat. A hole ⅝ in. in diameter and 2 in. deep was drilled in the center of a face of this block into which the bulb of the thermometer was inserted. An alloy melting at 300 deg. F. was mixed and poured to a depth of ⅛ in. over the face of this block, filling the ⅝-in. thermometer hole. In this way good heat conduction was obtained between the thermometer and any point of the molten alloy floating on the face of the block. To apply the tempering heat to a sample, all that was necessary was to get the block and its molten alloy to the desired temperature, hold this temperature constant, and then drop and float a sample of hardened steel on the bright surface of the alloy. By brazing a small quantity of pure tin to one of the samples it was determined that a sample came within 2 deg. F. of its tempering heat in 5 sec., and exactly reached its tempering heat in 8 sec. In these tests it was endeavored to control time to plus or minus one second and temperature to plus or minus one degree. This accuracy was maintained within close limits. Tempering heats were varied from 425 to 625 deg. F. in steps of 25 deg., and two samples were tempered for each of the following periods: 5, 10, 15, 20 and 30 sec., and for 1, 3, 5, 10 and 20 min. Samples were then matched side by side for color, and samples of the same color produced by different time and temperature combinations were grouped together. The hardness of the samples was then determined, and the variation in hardness for samples of the same color produced by different time and temperature combinations was determined. Then a temper-color scale was prepared in which time and temperature were both considered. In Table I this scale is shown. Samples of pure iron, carbon tool steel, chromium magnet steel, tungsten magnet steel, tungsten finishing steel, high-chromium high-carbon wortle steel, and high-speed steel were hardened, and the effect of carbon and the various alloys on the temper colors was determined. Surface conditions, such as smooth, rough, decarburized, and oily, were investigated, and their effect noted. The conclusions arrived at were as follows:

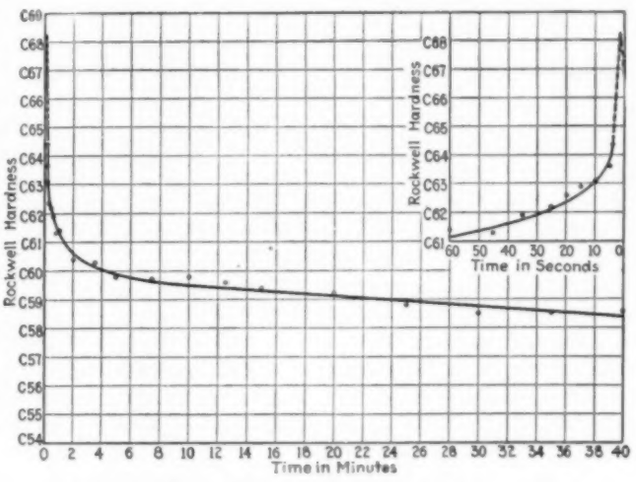


Fig. 13—Time effect in tempering carbon tool steel

1. The appearance of the temper colors is decidedly effected by surface conditions, smooth surfaces taking the color faster than rough or oily surfaces.

2. If temper colors are to appear at the same temperature, and over the same length of time at this temperature, then the air in contact with the surface tempered must be kept circulating at about the same rate.

3. High-carbon steel colors more quickly, and at a lower temperature, than pure iron or mild steel. Hence, it follows that all decarburization (soft skin) must be removed before tempering.

4. Alloying elements such as chromium and tungsten decidedly retard the appearance of the temper colors.

5. Samples drawn to the same color but for different time and temperature combinations show a decided variation in hardness. For example, a full straw color was produced by drawing for the following time and temperature combinations: 425 deg. F. for 20 min., 450

The third and last article of the series.

deg. F. for 10 min., 475 deg. for 5 min., 500 deg. for 2 min., 525 deg. for 1 min., 550 deg. for 20 sec., and 575 deg. for 8 sec. With all possible precautions taken, the variation in hardness of these samples corresponded to a hardness variation produced by a 75 deg. F. variation with the use of baths, or by the temper-alloy method described later.

6. Temper colors appear differently in artificial light than in sunlight. The purples, for example, have a red appearance in artificial light.

7. It is impossible for the eye to distinguish accurately between colors of nearly the same shade unless held side by side. Hence, for accuracy, standard samples must be prepared for matching temper colors.

8. Temper colors change gradually through the shades of straw (425 to 500 deg. F.) but much more rapidly over the purple and blue range (500 to 625 deg. F.). Hence, temper colors are more difficult to judge accurately between 425 and 500 deg. F. than between 500 and 625 deg. F. They are used, however, most frequently over the former range.

9. A dark blue always appears at a lower temperature than a light blue. Most temper color scales reverse this order, which is incorrect.

10. The lowest temperature that will produce a light straw in a reasonable length of time is 425 deg. F., although the whole temper color scale from straw to blue can be produced at 212 deg. F. by holding a piece of hardened steel for several days at this temperature. The hardness over this period would not change appreciably.

Importance of Time Control

The time that a piece of steel is drawn at a given temperature has a decided effect on the hardness of the same, and the time must be considered, therefore, in order to get consistent results in tempering. But "time is money," and therefore it is profitable to know the minimum length of time necessary to give consistent results in tempering. To our knowledge, the effect of time in tempering over second and minute periods from 3 seconds up to 40 minutes has never been completely investigated. Still, it is over these short time periods that most tool makers draw their tools.

To control the time element accurately very small test pieces were used, but as the timing was only started after they reached the tempering heat, the subsequent results can be applied also to large pieces. For this purpose 586 samples of 1.10-carbon tool steel, $\frac{1}{4} \times \frac{3}{16} \times \frac{1}{2}$ in. in size, were prepared, and all hardened at the same time, using a 1,400-deg. F. hardening heat. After hardening, they showed an average Rockwell hardness of C66.8, which increased to C68.3 by boiling in water for 30 minutes.

The tempering heat was applied by the use of the same block as was used for the production of temper colors, the test pieces being dropped on the bright surface of the molten alloy. The thermometer used was calibrated carefully, and all heat losses allowed for. The temperature can be considered correct to very nearly plus or minus 1 deg. F., and the time to plus or minus one second.

The time that it took a sample to reach the temperature of the alloy was determined by brazing pure tin and pure cadmium to the surface of a test piece and noting the time to melt these metals when the block was maintained at the melting temperature. It was found that the samples took 9 sec. to reach the tempering heat, and came to within 9 deg. of this heat in $3\frac{1}{2}$ seconds.

As timing was only started after a sample reached the temperature of the block, it follows that the curves plotted are nearly independent of mass, and can be used for large as well as small pieces of steel. Tempering heats were varied in 25-deg. steps from 350 to 625 deg. F. Time periods were as follows for each of the above temperature steps: 4, 5, 10, 15, 20, 25, 35 and 45 sec.; 1, 2, $3\frac{1}{2}$, 5, $7\frac{1}{2}$, 10, $12\frac{1}{2}$, 15, 20, 25, 30, 35 and 40 min. Three samples were used for the short periods, and two samples for the longer periods.

In the upper right-hand corner of Fig. 12 is shown the hardness variation for second periods up to 60 sec. while the other curve for the minute periods shows the time periods up to 40 min. These curves are representative of the others shown in Fig. 13. To avoid confusion, points forming the latter curves are not shown. If the curves of Fig. 13 are inspected, it can be seen that after five minutes of time at the tempering heat the curve becomes almost a straight line, so that little is gained by holding carbon tool steel longer than 5 min., or at the utmost 10 min., at its tempering heat. After about 5 min. the steel softens in direct proportion to the increase in time, and the curves from 5 or 10 min. up to 40 min. are straight lines. This is important to know, since holding steel for 2 hours at its tempering heat is often practiced.

From an inspection of these curves it will be noted that soaking over the range from 5 or 10 to 40 or 30-min. period softens the steel about one degree on the Rockwell C scale, and for equal time periods the average softening due to temperature variation will also be 1 deg. in hardness for every 25 deg. variation in temperature. It can, therefore, be seen that one minute of time (between the 5 and 40-min. periods) has about the same effect in softening the steel as 1 deg. increase in temperature. As minute variations in time are much more easily controlled than degree variations in temperature it can be said that if steel is held for at least five minutes at its tempering heat, for all practical purposes temperature variations will be the only source of error.

Drawing the Temper

In large plants on a production basis, tools are usually drawn in a salt or oil bath to any desired temperature by the use of a thermometer or pyrometer. Tools are, as a rule, placed in a basket, taking care to separate them sufficiently to allow the oil or salt to circulate freely. The basket with its contents is then heated slowly to the desired temperature, and held at this temperature for a definite length of time. Good results will, however, be obtained by heating the bath slowly to the desired temperature, shutting off the source of heat, and then letting the steel soak for 10 min. with the bath slowly cooling. The mass of the bath with its contents is generally of sufficient magnitude to prevent much variation of heat after the gas has been shut off. If a slow rate of heating is used the bath usually "overshoots" 2 to 5 deg., and at the end of 10 minutes is about 5 deg. F. under the desired temperature. In this way the time element is taken care of with little trouble.

Bath tempering often takes one or two hours, and unless expensive automatic heat control is used, baths must be watched while heating. Toolmakers, therefore, seldom use them. It is safe to say that 95 out of 100 tools in the average plant are drawn to color, or to the melting point of solder. We know that temper colors are inaccurate, and often introduce an error of 100 deg. F. in the tempering operation. Plumbers' solder, when mixed in the right proportions, will melt at 365 deg. F., but there is a decided variation in the commercial brands

on the market as to purity, and in proportions of tin and lead. Moreover, plumbers' solder, as ordinarily used by rubbing a thin stick on the tool being tempered, will show a variable melting temperature because of the varying conditions of heat conductivity from the tool to the solder. This error can be as much as 75 deg. F., and can easily be determined by rubbing a stick of solder on the outside of a tempering tank.

Bath tempering, when properly done, is accurate, but the temper-color method, and the use of solder, are not accurate. However, many toolmakers cannot, and will not, use baths, and it was for this reason that a system of tempering by the use of temper alloys was developed.

It is known that pure metals, and certain alloys made of combinations of pure metals, have definite and uniform melting points, so much so that they are used to calibrate thermometers and pyrometers. With this idea in mind the Cornish Wire Company succeeded in developing a series of alloys known as "Temperite" alloys, which are claimed to indicate temperature with an accuracy of plus or minus five deg. F. These alloys can be used to indicate any temperature from 300 to 625 deg. F. in steps of 25 deg. F. This range covers almost any condition of tempering in the toolroom. These alloys are made to indicate within plus or minus 5 deg. Tempering accuracy means nothing if the steel is not properly hardened to begin with, but if the initial hardness shown in the curve of the various steels is obtained, then alloys will give a remarkable degree of accuracy. Temper colors, by comparison, are but a crude method, because with the use of these alloys hardness variations can be controlled to plus or minus on half point on the Rockwell scale. Unless surfaces in hardening are clean enough to test without grinding, the grinding operation in itself often introduces an error. The surface of the steel may be heated and consequently tempered in grinding, or in the case of alloy steels, decidedly glazed in grinding, and thus cause high readings.

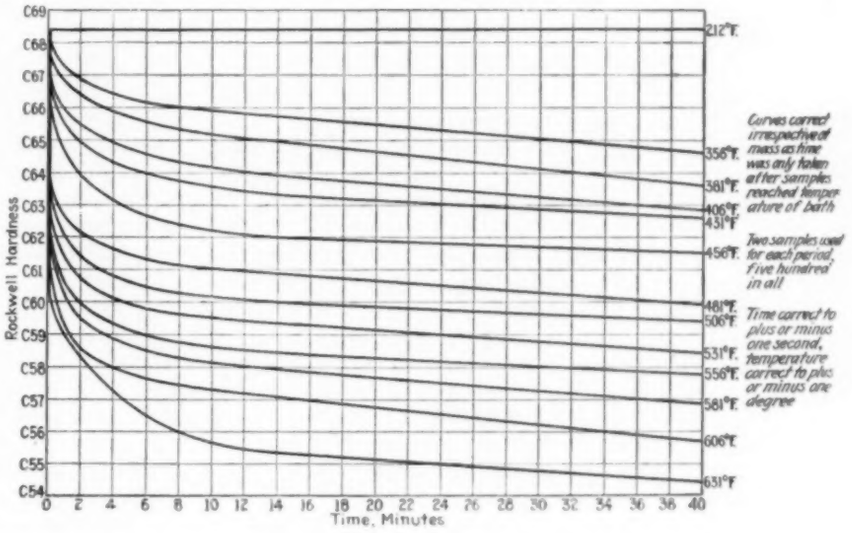


Fig. 12—Hardness variations for time periods in tempering

The way that the alloys are used is in strip form, the strips being $10 \times \frac{3}{16} \times 0.030$ in. in size. These strips are rubbed on the tool being tempered, or small pellets are cut from the strip and placed on the tool. As there is a heat loss between the tool and the alloy, it is necessary to use a flux to act as a heat conductor from the tool to the alloy. In the case of solid tools of uniform section, a hot plate is usually used. If the alloy is used in stick form a little flux is put on the end and occasionally rubbed on the tool. For accuracy, two sticks are used, one melting 25 deg. below the temperature of the other. If a pellet, or small square, is cut off the stick, it is placed with a small quantity of flux on the tool being tempered.

With tools of irregular shape tempering in the same furnace used for hardening is recommended. The air and gas are shut off, and if great accuracy is desired the furnace is allowed to cool to a black heat. The tool is placed on a sheet metal tray, and frequently removed from the furnace to allow the heat to equalize, and to see when the right heat has been reached.

For accurate control of time two alloys are used as described above. The tool is heated slowly during the last 25 deg., and after reaching the desired heat is allowed to air cool. When tools are small and heat up quickly, heating two or three times to the tempering heat controls the time accurately. In this case a tool need only cool until the alloy sets, then the heat is applied until it melts again. Care should be taken that a tool remains for at least 5 min. at or near its tempering heat. It will be remembered that after soaking for five minutes each additional minute only softens the tool as much as one degree rise in temperature.

Most of the Temperite alloys developed pass abruptly from a solid to a liquid condition during a temperature change of 3 to 5 deg. F. A few, however, soften a few degrees below their melting point, and in these cases, the tool must be heated until the alloy has the appearance of molten solder. The troublesome conditions of scale and decarburization are eliminated by the use of the tempering alloys. However, time must always be considered for accurate results. The alloys, also will indicate slightly different melting points, depending on whether they are used in stick or in pellet form, but this can be judged.

It is difficult to specify a definite temperature for drawing the temper of any class of tools because of the varying conditions under which tools are used. Taps give a good example. A large tap made of carbon tool steel for brass threading could be drawn to 300 deg. F., as this treatment would relieve the hardening strains, and still leave the tap hard for great wear. If such a tap were to be used on tough bronze or steel, a drawing temperature of 475 deg. F. would be necessary for maximum toughness. There would be a variation of about four points on the Rockwell scale between the two taps, but this condition would be necessary for good service in each case. Tools should always be drawn according to the strains encountered in use, and the critical ranges previously described should always be considered.

When maximum wear is required for water-hardening carbon-steel tools not highly strained, such as cutting tools for brass, they should be drawn to 300 deg. F., which relieves most of the hardening strains. From 300 to 350 deg. F. represents the range for the complete removal of the hardening strains, and is the tempering range for punches and dies for light blanking, and for tools that must resist the file test. Somewhere between

350 and 400 deg. F. the file begins to take hold, and this represents the range for tools and punches doing average work. From 400 to 450 deg. F. real toughening begins, and the range 450 to 475 deg. F. represents a decided increase in toughness with little loss of hardness. From 475 to 525 deg. F. represents the range for highly strained tools, and from 525 to 625 deg. F. is the range for the highest strained tools, such as punches and springs.

In general high-manganese oil-hardening steel must be drawn slightly more than water-hardening carbon tool steel. Most of the hardening strains are relieved at from 325 to 350 deg. F., and are completely relieved at 400 deg. F. At 500 deg. F. real toughening only begins to be evident in the steel.

High-chromium oil-hardening steel appears to be almost as brittle when quite soft as when hard. Dies, for example, hardened at 1,500 or 1,600 deg. F., and drawn to 375 deg. F. are soft, yet they break out at the cutting edge as readily as tools hardened at 1,750 deg. F., and drawn to 375 deg. F., and which absolutely resist the file. The best all-around treatment for this steel is to harden at 1,750 deg. F., and draw to 375 deg. F. With the type containing cobalt and vanadium the drawing temperature can be increased to 450 or 500 deg. F. Highly-strained tools can be drawn to 750 deg. F. In general, this steel is more brittle than the other types of oil-hardening steel, but is much employed for the lighter kinds of tool work, because of the great wear experienced through its use.

Right of Contract Shop to Manufacture Special Machinery

By Leslie Childs

THE question of how far custom and usage may be invoked to restrain a shop from making similar unpatented machines for different customers, is one on which there are various opinions. As an illustration, of judicial reasoning on this important question, a recent Massachusetts case may be reviewed with profit.

In 1918 one Gannon was engaged in manufacturing certain fasteners, and contracted with one Fraser to design and build a special machine for the making of these fasteners. No patent was ever applied for on this machine. Again in 1920 Gannon employed Fraser to design and make another machine. This machine was made under the supervision of Fraser in the machine shop owned by one Tufts, and the agreement between Fraser and Gannon was as follows: "It is a part of the consideration for which the above sum has been paid that Warren F. Fraser shall not design a machine for doing this work for any other parties, and shall not supply copies of this design to any other parties except John Gannon so shall instruct him."

Later one Varian negotiated with Tufts to build a machine that would make the same type of fasteners as were manufactured by Gannon. Varian gave Tufts a written order instructing him to proceed to design and build a machine for the production of the fastener, describing just what was required. Tufts thereupon engaged the services of Fraser to design and make working drawings for the kind of machine desired by Varian. It may be noted that Tufts did not know of the agreement between Fraser and Gannon. Also, Varian acted in good faith in making the contract with Tufts. When the machine was almost finished, action to restrain its building was instituted. This action was based on the well-known "custom and usage" in the machine shop trade that forbids a shop making a special machine for one person to make similar machines for other customers. The trial court declined to restrain Tufts from building the machine, and the case was dismissed against all the defendants except Fraser. The case was appealed to a higher court, which upheld the lower court and declared that, "The policy of the law is not to countenance contracts by which a person endeavors to restrain himself from doing productive work at any time, which is useful to the community and remunerative to himself."

In reviewing the case the higher court in part said: "The machine built for Varian is similar in principle not only to the 1918 model, but to the one subsequently built for Gannon. It was independently designed by Fraser without the actual working drawings and specifications of the previous machine, but his past experience on the Gannon machines was much relied upon. The only question before the court is that of the custom in the machine shop that a person building a special machine shall not make a similar machine for a different customer nor use the knowledge gained in the building of such a machine. Under such a custom the individual machinist is restrained and restricted in the pursuit of his trade, in that he shall not produce a machine that in its fundamental principles infringes a machine he has built at some previous time. The protection afforded by the alleged custom to an inventor of a secret machine not patented would not be reasonably necessary to inventors of machines, nor is it one to be approved by the court. The facts found do not warrant the contention of the plaintiffs that there was such a confidential relationship between Gannon and Tufts as imposed upon Tufts a duty not to make use of the knowledge of the basic principle of the invention of Fraser for Gannon.

25—50—33—55—24
56—72—73

NOT football signals—but time savings in per cent. These savings resulted from the purchase, installation and use of modern shop equipment. The replacements constituted 17 per cent of the machine tool equipment and have been responsible for a big increase in business. The whole story will be told two weeks hence in "What Modern Equipment Has Done."

· EXECUTIVE · FORUM ·

Executives are invited to discuss the problem involved in the following case
Accepted contributions will be paid for

DEPRECIATION RESERVES

AT THE request of his old friend, banker for Everett Jones of the Jones Machine Company, Mr. William Holland, "Bill" as he was more commonly known, unofficial consultant on business and industrial ills, had come to talk things over with that worried gentleman.

"It's very good of you to come in so soon to go over my troubles, Mr. Holland," said Jones.

"Not a bit of it," was the bluff rejoinder. "I get lots of kick out of just this sort of thing. And I'm glad to do what I can for any friend or client of that fish-eyed banker, Amos Hare. He and I have been working together a good many years. Just what does he object to in your statement?"

"Well," said Jones, reluctantly, "there were several things he found fault with but his biggest kick was on our equipment. I can't blame him him very much, for we haven't bought a new machine in several years. Didn't think we could afford to."

"I don't usually reach conclusions before I've studied the facts but this time I'll venture a guess that you couldn't afford not to. But let that rest a while. I want to see your equipment. Can we go out in the shop?"

Two hours later the two men came back and sat down again in Jones' office. Jones looked chastened while Holland's expression had an unspoken "I told you so" hardly concealed.

"Mr. Jones," he said, "I have never seen the man that could make a product to sell at a profit on equipment like yours. It just can't be done. You'll forgive me if I speak plainly."

Jones hastily assured him that he would.

"I can see several things that will have to be done before we can persuade friend Hare that he was really justified in making that loan," he went on, "but one of the strongest arguments will be to set up a depreciation reserve fund with a good healthy obsolescence factor in it. Let me tell you how we handled the same problem in a shop over in Michigan a year ago.

"That man's problem was much like yours. He simply had to have up-to-date equipment to keep up with his competitors, and whenever his superintendent asked for money with which to buy new machines there never seemed to be any.

"Well, to make a long story short, we set up a reserve fund in which was put aside each year an amount equal to one-fifth of the value of the machinery in the production line. Some units will last longer than five years—others will become obsolete in less time, but we figured that that was a fair average. Then when new equipment was needed there were funds available."

"But, Mr. Holland, what happened in case good maintenance kept a machine in service longer than your five-year period? I suppose you stopped the annual reserve accumulation at the end of that time."

"Not at all. Some people do that, I know, but we figured it to be better business to keep right on. Equipment is getting better and considerably more expensive. The replacement machine usually costs more than the old one and in this way you have something to make up the difference. Get the point?"

"Yes," said Jones, "I get the point all right but it seems to me like putting a lot into equipment reserves. A business that could do that and have anything left for dividends would certainly be a paying proposition."

"It would," agreed Holland. "And if I'm any judge, our banker friend wants your business to be just that.

"But that isn't all. You'll remember I said when we first came out of the shop that you couldn't operate profitably with old equipment. That difficulty is overcome by this type of depreciation reserve. It enables you to get the latest machines so that you can cut your payroll, speed up your work in process and reduce your unit costs. And, after all, that's what you should be aiming at. If you hit the mark you won't have to ask any favors of the banks. They'll be soliciting your business."

Book Reviews

FEDERAL AND STATE LAWS RELATING TO WEIGHTS AND MEASURES. Published by the Bureau of Standards, U. S. Department of Commerce. Copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price $2.30.

THIS book has been revised to present existing laws of the states, territories, insular possessions and of the Federal Government of the United States. This is the only publication in the field and includes federal laws and regulations relating to fundamental standards.

The scope of the laws contained in this compilation and the wide application and interest which weights and measures have, in general, to the conduct of business, make this compilation a very valuable reference work and guide to a large number of different lines of business. Among such classes of business which may be mentioned especially are manufacturers of, dealers in, or shippers in interstate commerce of measures and of containers as well as the commodities considered in the laws presented.

MECHANICS OF MACHINERY. By C. W. Ham and E. J. Crane. Five hundred and four pages, 6x9 in. Cloth boards. Illustrated. Indexed. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y., Price $4.

TWO phases of the subject are dealt with in this book: mechanism, and kinematics and dynamics of machinery. Part I is intended to cover the fundamental mechanisms and the theory of their operation. General principles are first discussed, followed by specific studies of linkwork, cams, spur gears, bevel and skew gears, belts and chains, intermittent motion mechanisms, and trains of mechanisms.

Forces as well as motions are analyzed in Part II, which occupies about sixty per cent of the volume of the book. Emphasis is placed upon those problems in regard to inertia forces that exist in high-speed machinery. At the beginning of this section, a chapter on fundamentals is included for the purpose of providing a brief outline of the basic principles of mechanics stated in the same language as that employed in subsequent chapters. Velocities in machines are treated both analytically and graphically and are solved by two methods: that of relative velocities, and that of instantaneous centers. Accelerations are treated in a similar manner.

Before discussing the dynamic forces in a machine due to the inertia of its parts, the authors devote a chapter to the static force analysis of machines. The modern subject of balancing of machinery, one of the most important applications of the study of inertia forces, is then covered. The balancing of automotive engines receives considerable attention. In the appendix a complete force analysis of a gasoline engine is given. There is also a chapter on governors.

The statement of each topic is necessarily brief, and only sufficient material has been included to bring out general principles. If detailed information is required, it may be obtained through the list of references at the end of each chapter. Problems are also given at the end of each chapter. These are intended to serve as a guide in presenting drafting room work in connection with a course in the subject.

ANALYZING WHOLESALE DISTRIBUTION COSTS. By J. W. Millard, Domestic Commerce Division, Department of Commerce. Free distribution. The present study is one of a series to be issued from time to time showing in detail some of the results actually accomplished in this field by practical business concerns. In recent years enormous strides have been made by manufacturers in increasing their efficiency, reducing their costs, and eliminating unnecessary wastes. Similar improvements have been made in the field of distribution as a whole, but there are many evidences, as witness the work cited in this book that forward-looking distributors are grappling with these problems. The years to come bid fair to see some revolutionizing methods adopted that will tend to take much of the existing guess work and uncertainty out of marketing costs and greatly increase efficiency in this phase of commercial endeavor.

MARKET RESEARCH AGENCIES. Issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce. The second edition of this book is now available. This publication purports to provide persons interested in market investigation with a source book to the research work in that field by private and public agencies and individuals, and to eliminate duplication of research by making public what others have done, are doing, or contemplate doing. Adding to the value of the 1927 edition is the fact that there are reported 544 agencies, or 82 per cent more than listed last year. Some of these agencies and their work are new; others have been discovered since last year, and most of them are engaged in research of increasing importance. The publication indicates by its growth the progress of market research toward solving the problems of distribution. The book presents its data under five main research groups: (1) Federal government, including the Department of Agriculture, Department of Commerce, Department of Labor, the War Department, Tariff Commission, Federal Trade Commission, Federal Reserve Board, Federal Board for Vocational Education, and Congress; (2) State and municipal government; (3) Colleges, universities and foundations; (4) Book publishers; and, (5) Commercial organizations.

NIGHT WORK IN INDUSTRY. Published by the National Industrial Conference Board, Inc., 247 Park Ave., New York. Paper, 6x9 in., 45 pages. Price 75 cents. The purpose of this study of the National Industrial Conference Board has been to present in a concise form the experience of a representative group of manufacturing establishments with night work operations. The results permit of a number of general conclusions. Night work in industry presents no peculiar difficulties if it is properly organized, and if it means steady employment. The problem of night work would be simplified if all establishments were in a position to keep their night forces permanently employed on a rotating system of shifts. Establishments that assign their workers permanently to night work find it difficult to attract skilled and reliable employees for night work. The greatest difficulties with night work are experienced by the establishments that are forced to employ night workers temporarily at certain seasons of the year when the output of their day forces is not sufficient to meet the seasonal demand for their products, or, as in the canning industry, when a certain amount of work has to be done in a limited period of time.

The study shows that, if properly supervised and organized, night work may be as productive as day work.

Pusher-Type Furnace Heat-Treats Screws

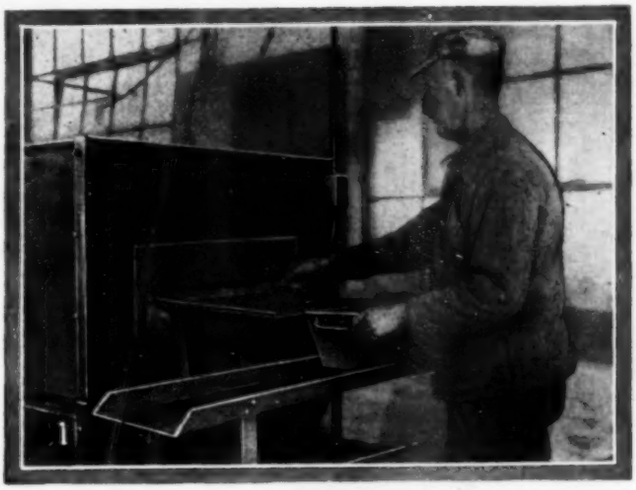


Fig. 1—Setscrews, bolts and similar products are fed through the furnace by cam-operated pushers, arranged so that their strokes alternate, thus permitting the operator to load the parts in troughs consecutively starting at the left-hand side. The pushers return to the outward position after having forced the work into the heating chamber, so that another piece can be loaded. After the pushers have completed several cycles, the work forms continuous lines in the chamber, after which additional cycles force out heated pieces at the opposite end of the furnace

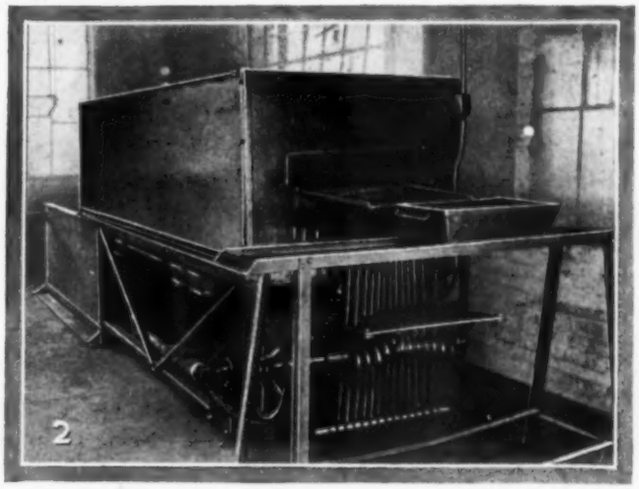
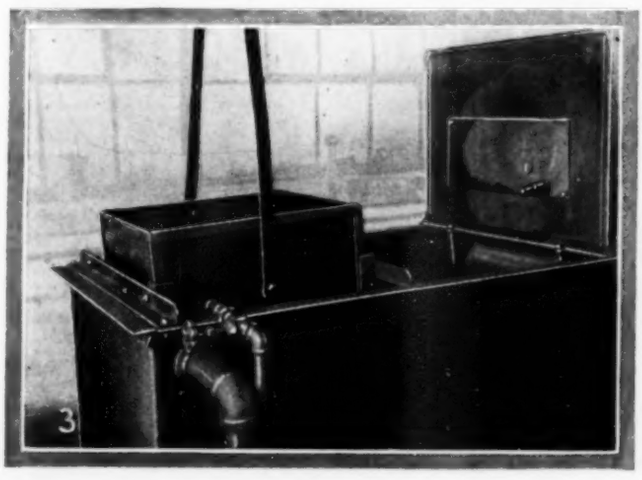


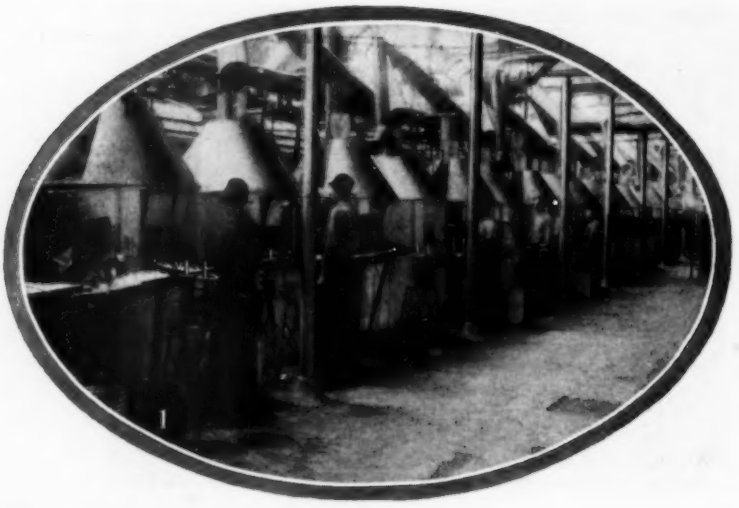
Fig. 2—The pushers are operated by a camshaft, located at the front end of the furnace, and chain driven by an electrically-operated motor, mounted under the furnace. Work is placed in tote boxes resting on the angle-iron stand, shown in the front, to facilitate loading. There are thirteen rows of screws fed through the furnace simultaneously and a cycle, feeding a screw to each row is completed in 45 sec. The pieces being treated are spring bolts, and are heated to 1,450 deg. F., after which they are drawn. Prior to this treatment the bolts are carbonized. Parts such as upset setscrews, are heat-treated in order to remove forging strains. The troughs are V-shaped so that the work cannot get out of place after entering the heating chamber

Fig. 3—At the opposite end of the furnace, heat-treated pieces are automatically discharged into the quenching tank. The parts fall on a chute having a steep incline, and so arranged that the work passes through the quenching bath and into a basket resting on the bottom of the tank. The tank is deep, running 6 ft. under the floor level, to insure the work being properly quenched. The loaded basket is withdrawn from the tank by an electrical overhead hoist. When the basket is raised, a gate, located at the bottom end of the chute, is closed so that the work will not fall into the bottom of the tank. After a load of parts has been emptied into tote boxes, the basket is replaced in the tank, and the gate on the chute is opened to release whatever work has been accumulated. The furnace is electrically operated, having pyrometers and switches located on a panel at the left of the discharge end



Photographs by courtesy of the Ferry Cap and Set Screw Company, Cleveland, O., and the Hoskins Manufacturing Company, Detroit, Mich.

Production Methods in Heat-Treating



Pictures submitted by J. B. Nealey
American Gas Association

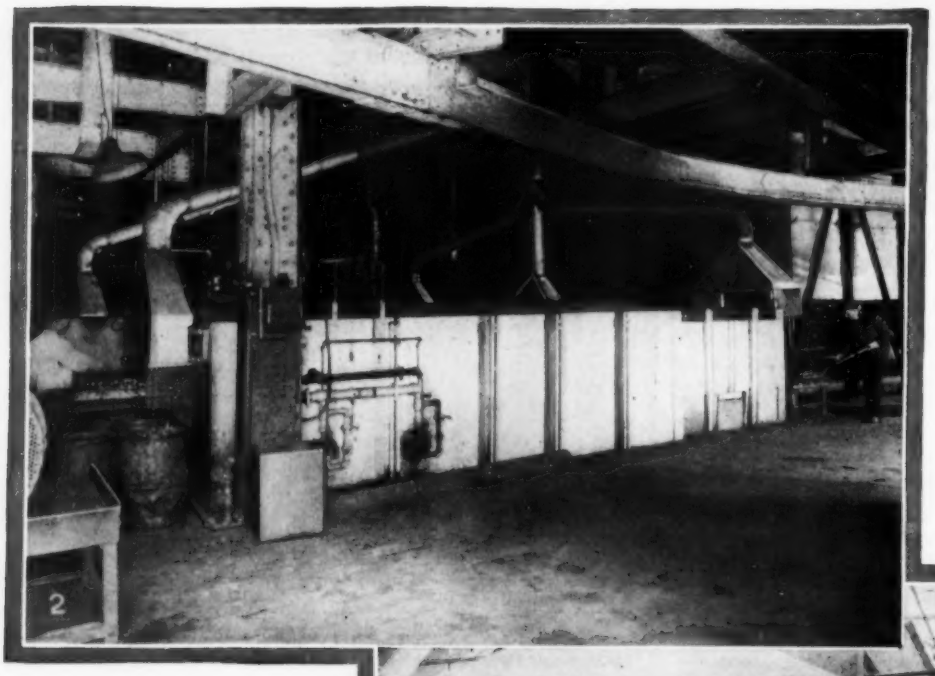


Fig. 1—A battery of 66 hooded cyanide pots for casehardening automobile transmission disks, brake drums, gears, and other parts. The pots are arranged in three rows, and the work is brought and removed continuously. Some of the pots are equipped with duplex disk quenching machines. The correct temperature is controlled in a special pyrometer room

Fig. 2—A continuous annealing furnace for annealing castings. The furnace is 30 ft. in length, and fitted with rails on the hearth, the work being pushed with an electric rocker-arm type of pusher, properly timed

Fig. 3—Equipment for heat-treating coil springs. The two hardening furnaces at the right are 16 ft. long, and are equipped with electric pushers to move the work through the furnace in from 10 to 20 min. The furnaces are gas fired, and automatically controlled at a temperature of 1,475 deg. F. The oil quench at the right is kept at a temperature of 90 deg. F. The two nitrate tanks in the center are for drawing the work. They have four burners each, are hooded, and kept at a temperature of from 600 to 775 deg. F., according to the work being treated

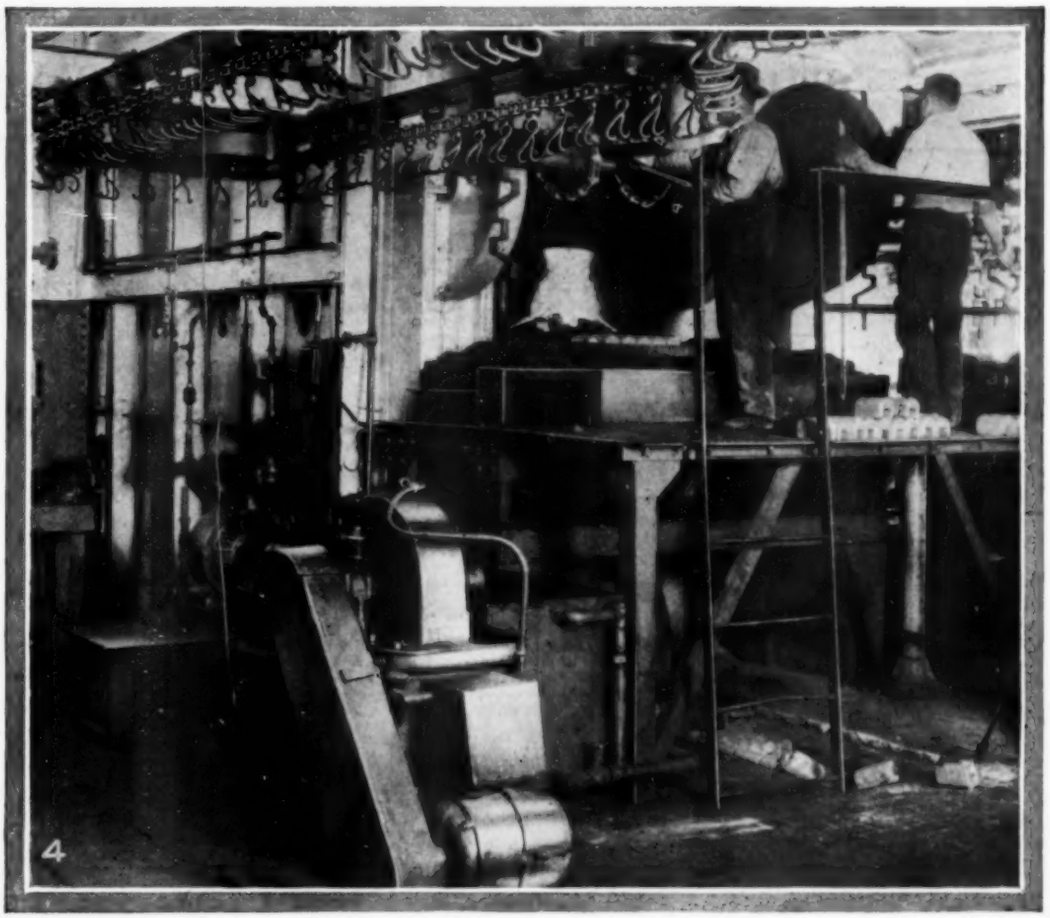


Fig. 4—A double-deck furnace for hardening and drawing automobile crankshafts. The hardening is done in the lower section and the drawing in the upper section, the waste heat from the bottom being utilized in the latter process. The furnace is 30 ft. long, and the crankshafts are propelled by an electric pusher, so timed as to give the work a heating period of 40 min. at a temperature of 1,480 deg. F. As the shafts are discharged, they are clamped into a rotary spinner which dips them into a caustic soda quench. They are then placed on an endless chain conveyor which carries them through the upper section for 40 min. at a temperature of 650 deg. F. The furnace has five gas burners on each side of the lower section, firing under a brick muffle, and the temperature control is automatic

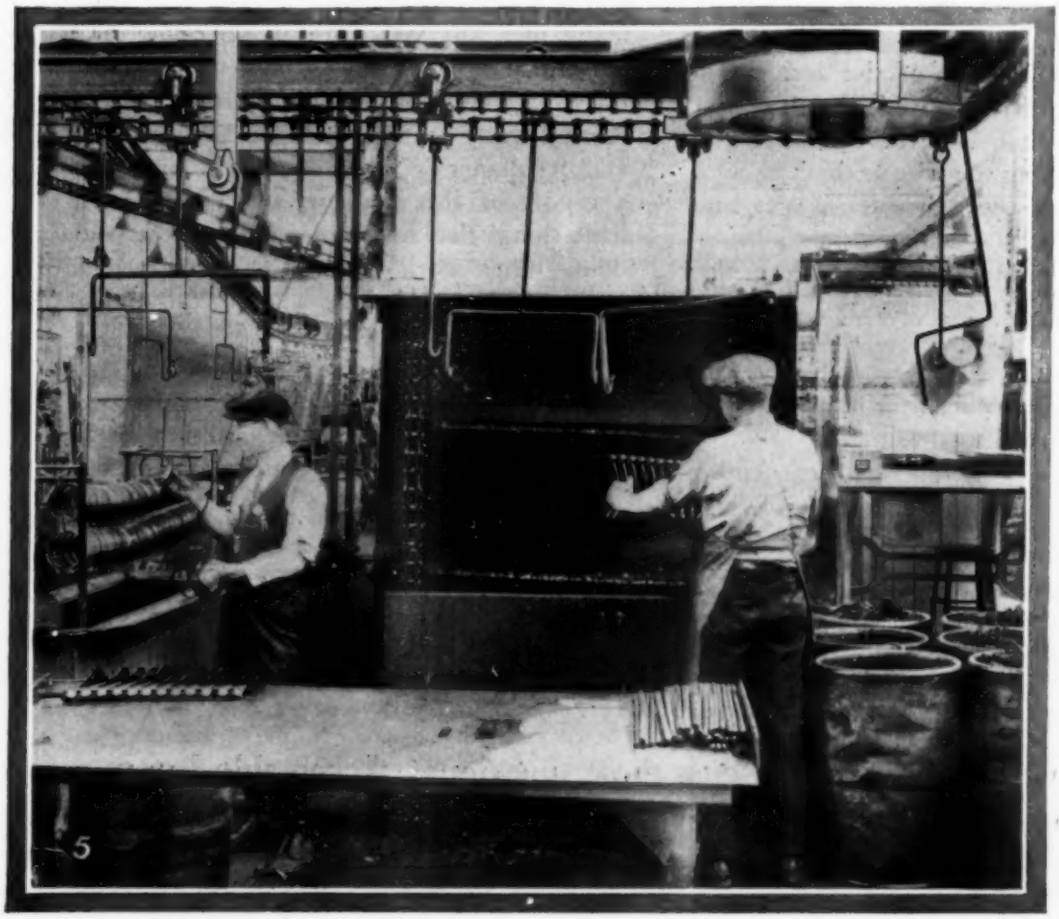


Fig. 5—A continuous japanning oven for automobile parts. The oven is 40 ft. high, and the work, after being dipped automatically in the japan tank, is carried up and down in the oven several times, and then back to the point of beginning, where it is unloaded. The burners are located in the back of the oven, which is partially divided from the front by a partition. The baking is done in the back, while the waste heat goes into the front part and preheats the work

THE · FOREMAN'S · ROUND · TABLE

The Hidden Costs of Accidents

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

WILLIAMS had been giving a talk on the accident question, and bore down quite hard on the necessity of everyone keeping the safety thought in mind at all times. The reactions, of course, were varied.

"Seems to me the 'super' laid it on a bit thick about accidents this morning, Al," said Ed, on the way home. "We don't have so many accidents, and the company is insured, anyhow."

"It isn't just the cost of the accident in wages and doctor's bills, Ed. There's a lot more to it than that—it's the rest of it that Williams was trying to make us think about."

"Just what is there besides wages and doctor's bills, Al?"

"Guess you must have been asleep this morning. Didn't you hear Williams say that the other costs were more than the doctor's bills and wages put together?"

"I heard him, Al, but I don't get it. Sounded a bit overdrawn to me."

"Not a bit of it, Ed. Williams knows what he's talking about. I've seen it estimated that the average accident costs about four times the compensation and doctor's fee. Take that accident to Bill Rogers last month. He got the planer tool caught, and when it broke he was in the way of the flying pieces. Didn't improve his looks any, but besides that, see what happened—broken tool, tool block twisted, and the cross rail had to be tested to see if it was sprung. How many men stopped work to see what had happened to Bill, and to help him? How much of your time did it take to get things cleared away and get the work started on another planer? Then, you had to make out a report of the accident, and do a lot of little things that take time, and prevent your doing other work. No, Ed, I don't think Williams exaggerated it a bit in this morning's talk."

"Well, Al, I hadn't exactly thought of all those items belonging to the cost of the accident. Maybe they do. Guess perhaps we'd better watch things a bit closer after all."

Did Al point out the main points of accident expense? How much does an accident upset routine production? How much does it affect the foreman's job?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Making Time Studies

THE time study taken in the open is by all means the satisfactory one, and to my judgment and experience, it appears to me that the time-study man who finds himself forced to take a time study of any particular operation in a secret manner is a man who does not have the proper qualifications to gain the confidence and co-operation of the operator. It tends to prove that he is not thoroughly qualified for making time studies. It is not always necessary that a time-study man be thoroughly familiar with all types of machines and assemblies, but he should know feeds and speeds adaptable for different classes of metals. He must be familiar with the fundamentals and rudiments of the time-study system, and above all, should be able to determine what is considered a fair day's work. The advantages in taking a time-study in the open are that it gives the time-study man an opportunity to examine thoroughly the operation in question, and to offer any suggestion that he feels will be a help to the job. There are many points, possibly, that he will want to discuss with the operator before taking a time-study, and after he has done so and convinced the operator that he not only wants to time his operation, but to help him to become more efficient, he has at once secured the confidence of the man in question. This man is now ready to help him, and in many cases will show the time-study man things which he never would have known if he had not made this personal contact with him.

—WILLIAM M. JAHN.

IT IS exceedingly bad practice for a time-study man to work under cover, and I believe there is nothing in shop management which would justify such a procedure. Such methods are usually resorted to in order to check timings already taken. A time-study man who feels he has to make a practice of this is only admitting his weakness in doing so, in that he is not sure if the man on whom the study was taken has given him an even break. Moreover, if such a practice is allowed to exist, the men in the shop will soon "get wise."

I have found that a far better study can be obtained if the time-study man will first gain the confidence of the operator on which the study is to be taken. This can be done by assuring him the management is not spending the money to make the study with the view of getting as cheap a job as possible, but rather with the idea of determining if the tools and equipment being used are correct for the work performed, and are being used to the best advantage, that all lost motion will be eliminated, and that the operator will be paid a fair price for the job being done. This will make the operator feel at ease, and will encourage him to give a good, fair study.

—C. L. ANDERSON, *Methods Engineer.*

THE · NEXT · TOPIC

Giving Men Credit for Good Work

ADVANCE QUESTION

Williams inaugurates a plan of posting bulletins about men who do especially good jobs. Al favors it, but Ed is doubtful as to its wisdom and value. Who is right?

Side-Tracking an Old Customer

AN OLD customer, who has a background of long and profitable relationship with the organization, should always have the preference, and even to entertain the idea of side-tracking an old customer's order in favor of avoiding a delay on a new customer is the height of folly. The old customer's business, looking at it from a purely selfish viewpoint, is a definite well-established fact, while the new customer's is only an intangible hope. A new customer's order may often never repeat, due to many factors entirely out of the control of the company holding his order, with the consequent result that a steady, pleasant, and profitable relationship, such as the old customer's, may be sacrificed to no purpose. Looking at it from the old customer's viewpoint, he has every right to expect not only an even break, but but actual preference. His business is obtained with the minimum of sales effort, his credit standing has been definitely established, and his wants are bound to be more definite. These are all factors that increase the percentage of profit on his orders, other factors being equal. The new customer, if he is a reasonable business man, will appreciate a firm that frankly regrets the delay, but refuses to sacrifice an old customer to avoid it. He will see that while it may momentarily embarrass him, there is a distinct advantage and security in his placing future orders to attain the status of an old customer. In the end, both new and old customers of the right kind will acknowledge the desirability of such a policy.

—JOHN F. FITZGERALD.

Christmas Parties for the Plant

EVERYONE who celebrates Christmas looks on it as a time of great joy, and a social time for the plant brings out the spirit of Christmas. We have had them in our shop, and they have always been successful in every way.

—WM. J. FISHER, JR.

WITH the proper background, the Christmas party will be a big boost for the company, and will greatly repay the management. A man's family, particularly his

wife, usually has to listen to his grievances, real or imaginary, and if they are acquainted with his foremen and supervisors, they can often point out to him the unreasonableness of the resentment his imagination may be building up against a particular supervisor, and start him out on the right track once more. In this way alone, the company will be fully compensated for the energy expended on the Christmas party. So by all means, let's have it! —JOHN W. KANE.

Receiving Personal Mail in the Shop

THE man who mails a letter to a friend, and puts on the shop address may know no other address, or he may have reason for not wanting it to go to the man at his home, and there are plenty of legitimate reasons for that wish, but whatever his reason Uncle Sam considers it his duty to get the letter to the man as expeditiously as possible. For anyone, shop owner or otherwise, to slow down the delivery of the mail by putting it in a rack, or forgetting which pocket he put it in, shows lack of appreciation of what the mails are for. If a man gets too much mail, a word to him asking him to have his mail addressed elsewhere is enough, but if it comes to him at the shop, give it to him promptly, so that it will lose no value in transit inside the shop. —ENTROPY.

Foremen as Inspectors

ADDING the burden of inspection to the myriad of other responsibilities the average foreman has to shoulder is unfair. If he has any time left after setting up jobs, chasing material, settling wage disputes, getting out the scheduled work, and attending to the numerous details of his job, he should be allowed to use it to improve conditions in his department.

The foreman and the inspector can work together if they both have the same ideals. Many inspectors think that their sole duty is to check the work, and some foremen encourage this idea by disregarding suggestions of a corrective nature made by inspectors. Much better results would be obtained if foreman and inspector went over the first piece taken off a new set-up. Then if the part was not within the limits, they could check back over the set-up, and using their combined experience discover the trouble much more quickly than would otherwise be the case. —HARRY KLINE.

UP TO 1927 in our plant we had a system of inspection whereby the jobs were inspected at the department when the operator had completed the entire order. The results were sometimes very sad, for the foreman can only make a sort of hit-and-miss inspection as the work progresses. Then, beginning in 1927, we eliminated the set-up man idea and put in a floor inspector who was by experience familiar with many of the jobs. The foreman now does no inspecting at all.

The floor inspector checks the first piece of a lot and makes rounds of checking up as the jobs are being machined. He relieves the foreman of the duty of finding out whether slightly defective castings can be used or must be welded. He reports to the foreman and to the chief inspector any discrepancies, and determines whether the part can be used, scrapped or repaired. The method of repair, of course, is up to the foreman. When the entire order is finished, each piece is inspected by a final inspection department. With this system, the ratio of scrap and repair for the first nine months of 1927 was reduced 60 per cent from what it was for the corresponding period of the year before. —CLARENCE B. FOSS.

IF A foreman just says, "Leave it to the inspector," what will happen? Every one of his men will feel that the foreman is issuing a challenge to the inspection department to find bad work if it can, and this means that the men will follow suit by slipping everything over on the inspector that they can. If the foreman inspects work too, it makes the inspector feel like supporting him in turn, for he knows that he will be respected, and that all errors will be called to his attention for investigation. It is the occasional inspection by the foreman that counts, and not the 100 per cent inspection which he could not, and is not expected to make. —ARTHUR HALLIWELL.

ALL foremen are inspectors in the fullest meaning of the word. It is the man's business to know that his job is right before he turns it over to his foreman as finished, and the foreman's business to satisfy himself with the work before the inspector is called in. The inspector is not responsible for the production of poor work. This is the foreman's responsibility, but the inspector is responsible for passing the work along. Both the foreman and inspector are working toward a mutual end, which is maximum production with the least cost and with the degree of quality that is needed for the product being manufactured. —W. B. DESHER.

Posting Too Many Rules

THERE is nothing more insulting to a man in the shop who does not do the things which he knows to be wrong than for the management to put up notices that this or that thing must not be done on penalty of dismissal, and nothing will cause a man to do a thing so quickly as to have to pass a "forbidden" sign. He will then try to see if he can get away with it. Put it up to the foreman. He knows what is going on, and who does it, but as long as things are moving smoothly and the work coming through, generally, he will let those "forbidden" things pass. —C. G. WILLIAMS.

AL SHOULD have added another reason for reading the rules. His curiosity got the best of him, and he would have read the new set of rules even if he were not a foreman. A foreman who posts a new rule in his department knows that it will be read, not alone because ths men are curious to know what it is all about, but also because they know that the rule just posted must have some bearing on their jobs. However, a wise foreman will not post too many rules, as some men will be only too glad of a chance to stand in front of the bulletin board —R. J. BESS, *Assistant Foreman.*

WHEN a company contracts to do work under certain conditions, the business is transacted on paper to avoid later misunderstandings. When a man is employed by a company, he is really under contract, and

will receive pay each week, according to the conditions of his agreement with the company. Such rules and conditions which govern this employment should be posted in a conspicuous place. In this connection, the foreman should have three responsibilities: To read the rules himself, to see that his men read them, and to see that they are enforced. Posted rules governing personal or shop cleanliness should be unnecessary.

—Roy E. Peterson.

IN DEVELOPING the best conditions, the co-operation of everyone possible must be obtained, and it is questionable if there is any better way to get co-operation and produce results than to print short, concise reports of progress from time to time as to efforts to reduce number of accidents, fires, or to improve safety conditions, etc. Depending on foreman to see that each employee is properly instructed in the system of handling orders, dangerous conditions, and other things, means that there will be a percentage of employees that will not be properly instructed. Many employees who would resent special instruction or caution from foremen would read with interest printed instructions, and possibly suggest improvements. —R. S. Newton.

Keeping Track of Improvements

IT SEEMS to me that most designing engineers resent the shop making improvements upon their design. In most cases when they are approached, the regular reply is: "This is what the customer calls for, and we have supplied him with prints, so we cannot change it." At this stage negotiation ceases, and everything is apparently forgotten, until, perhaps, on the next order we see the shop suggestion has been utilized, with some slight change, and the credit then obtained by the engineering department. The scheme of having an engineering design form is a good idea, and would help the management of any factory to give credit where it is due.

—C. L. Henry, *England*.

Saving the Job of the Careless Workman

ANY careless individual, regardless of his shop standing, should be hauled up before the chief and severely reprimanded. In addition to this, he should be suspended from work for a definite period, depending upon the seriousness of his offense. Diplomacy must be used, for if the punishment is too severe, the good will of the man will be lost. But, if he is given a clear explanation of the fact that he is being punished for his own future benefit, he will accept the suspension, and, without doubt, he will not be a second offender.

—Harry Otterson.

SINCE this was Miller's first error through carelessness, and he did little damage, it was unnecessary to go to his home. He should have been warned and reinstated. If Joe had been in the habit of making errors, and some interested person wished to save his job, then it would have been all right to appeal to Al to find out where the trouble lay. Otherwise, I think it would be better to let the man go as an example to the men. It would not be good for any foreman in any plant to investigate the outside affairs of his men.

—George W. Cummings, *Superintendent*.

WILLIAMS was highly justified in his course of action, and he is to be commended for it. We hope that he would have gone into the matter just as deeply whether he knew Miller's family or not, and that under any circumstances he would have made a thorough investigation before dismissing any man.

There are many things not related to the work itself that affect a man's personal efficiency while on the job. These things should be given consideration by those who, by virtue of their fitness, society and industry have placed in command, and they should not deal too severely with those who are less fortunate. If the under-dog had as much or more sense than the man in charge, it is likely that the situation would be reversed.—J. D. Stewart, Jr.

TO JUSTIFY Williams in trying to save Miller's job, we must find some extenuating circumstance, since he had previously been warned for his carelessness. If Miller had a long and good record previously, if his work was of such an exacting nature that a new man though inherently careful might have gotten in similar difficulty through lack of experience, or if it would be impractical to replace him, then Williams was right.

Once the reasonableness of trying to save Miller's job was established, it was both proper and logical to go into his home, or resort to any means, to find the corrective answer. If a man is worthy of being saved to the organization, every means of "redeeming" him should be fully followed out. —George W. Hardman.

Insurance and Savings in the Shop

A WORKMAN living from hand to mouth is not only doing an injustice to himself, but is not fulfilling his obligations as a good citizen by not making provision for the years when his earning capacity will be diminished to the extent that he must depend on relatives or on public institutions for his living. The company is justified in organizing thrift on a business basis, but must exercise vigilance that its aims are not defeated somewhere along the line between the head of the company and the employee. Every supervisor should be in sympathy with any such movement, and should also understand the plan thoroughly. —F. M. A'Hearn.

Getting Ideas from New Men

AL CAN find out more about the man in ten minutes by asking a simple question than he could in an hour by any other method. By asking a man for an idea, even though he cannot always use it, he paves the way for putting his own ideas across more easily. He also promotes goodwill by giving the men leeway on methods.

The foreman who does not allow his men any leeway is not progressive. The foreman must be a strong, reasonable, intellectual man to carry out the idea of taking suggestions from men, but does any company want any other type of man in the position of foreman?

—J. B. Allison.

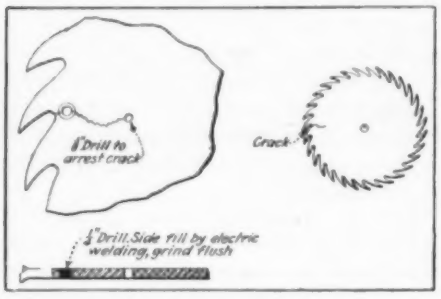
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of infomation on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Repairing Cracked Saws By Welding

By M. W. Elmendorf

In repairing cracked saws, the end of the crack was found by using a magnifying glass, and a $\frac{1}{8}$-in. hole was drilled at that point to prevent the further development of the crack. Through the crack, at the root of the tooth, a $\frac{1}{4}$-in. hole was drilled and afterward countersunk from both sides. This hole was filled by arc welding, forming a button that was absolutely tight, as well as fusing the metal of the saw so that it rang true when struck with a hammer.



Salvaging a cracked saw

The operation of welding was performed so quickly that no checking or warping occurred. Grinding the deposited metal flush with the saw at both sides finished the job. The sketch shows how the repair was made.

It is obvious that a saw so repaired is not as good as a new one and it should not be used for severe service.

Washing Cylinder Blocks

By Herbert F. Crawford

A very convenient method of washing cylinder blocks is in use in the Kenosha plant of the Nash Motors Co., a general view of the washing machine and cleaning tank being shown in Fig. 1. The cylinder block comes from the last machining operation and enters the washing machine at *A*. On its way through the washing machine it is subjected to a spray of hot cleaning solution, and finally emerges, as shown in Fig. 2, sliding into the rinsing tank to be seen at the end of the conveyor. Curtains at each end of the machine confine most of the steam to the inside, while ventilating hoods at each end carry off any vapors that might be obnoxious.

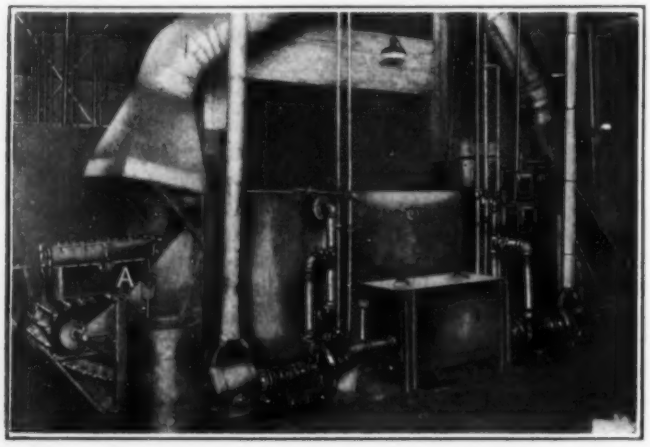


Fig. 1—Washing machine in the cylinder block line

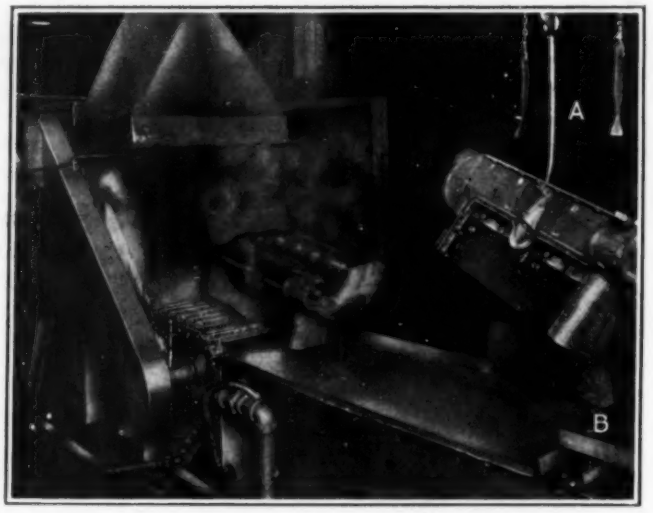


Fig. 2—The discharge end of cylinder-block washing machine

An easily-operated hoist is placed over the discharge end of the machine, the control handles being shown at *A*, Fig. 2. The hoist lifts the clean cylinder block out of the rinsing tank and passes it on toward the assembly line, depositing it on the table shown at *B*. This equipment has proved very satisfactory, as it leaves the cylinder blocks perfectly clean and in condition for assembly without further delay. Incidentally, the blocks are much more agreeable to handle in this condition.

Developing a 60-Degree Angle Gage
Discussion

By Matthew Harris

In an article under the title given above, published on page 745, Vol. 67 of the *American Machinist*, Harry D. Summerfield says that the first method considered for setting up the master gage for grinding the sides, was to set a sine-bar to the 60-deg. position on the angle plate, and with one side of the gage against the sine-bar to grind one of the other sides, resetting the gage until all three sides were ground. He says "This method was

discarded, owing to the impossibility of setting the sine-bar accurately to an angle greater than 45 degrees."

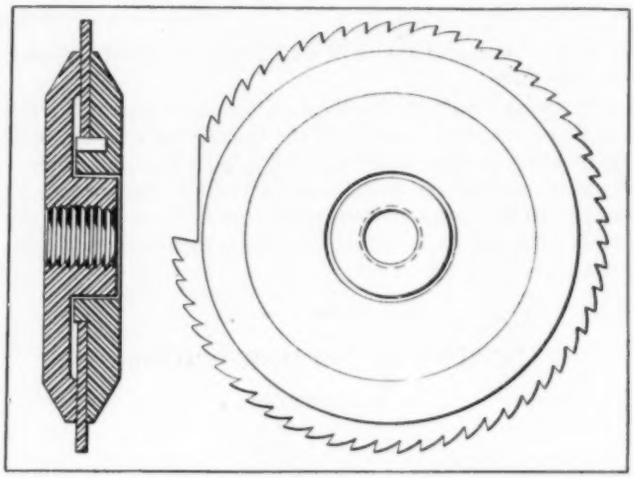
If the angle plate used by Mr. Summerfield was square on all sides, he could have laid it on one side and set the sine-bar accurately to 30 deg., so that when stood up it would have been at 60 deg. If this method had been followed, the gage could have been ground without any of the tedious cut-and-try methods described.

Salvaging Broken Slitting Saws

By W. F. Bishop

We had a number of slitting saws in which some of the teeth had been broken out, and were consequently of no further use on the milling machine.

By making a clamp collar as shown in the sketch, the



Clamp for using a broken saw as a cutting-off tool in a screw machine

saws were made use of as cutting-off tools in our No. 0, Brown & Sharpe automatic. For cutting off tubing and small parts they worked admirably.

Making Erasures on Tracings

By Adrian J. Dickson

The general neatness of a tracing goes a long way toward holding the good will of the chief draftsman.

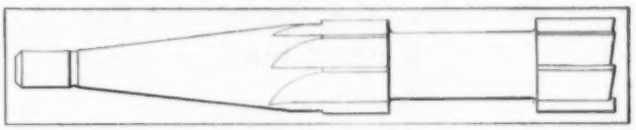
Draftsmen often use a soft pencil in making a drawing because the lines are blacker than if made with a hard pencil, and the drawing is easier to trace. If a mistake is made in tracing, the usual scraper and ink eraser are resorted to. Sometimes the erasing is overdone in the effort to get out all the ink marks, and a hole is made in the cloth.

If, instead of rubbing or scraping so hard on the inked side of the tracing, the draftsman will remove a few thumbtacks and turn the tracing over, he will find that the soft pencil marks have been "offset" from the drawing to the tracing cloth, due to hard rubbing with the eraser. These "offset" marks showed through the tracing and made it appear as if the ink marks had not been completely erased. The marks can be removed by rubbing with art gum. Rubbing with art gum will also help to iron out the sharp creases made by the blades of the ruling pen.

A Combination End-Mill and Size Plug

By H. V. Wassmonth

The regular practice of tool and diemakers in machining bushing-holes, etc., in jigs and fixtures is to bore them, using mandrels to check the measurements between the holes. This method means cutting and trying until



How the end mill should be ground

the required diameter or size is attained; also getting the work away from the cutting tool far enough to use the mandrels or size plugs to check the measurements between holes, all of which consumes a good deal of time.

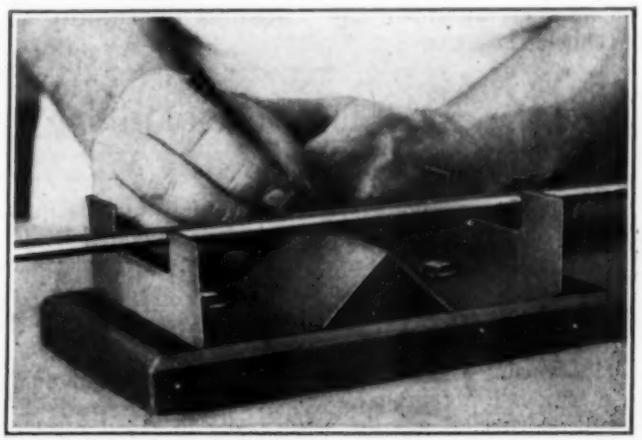
A much easier, faster and accurate method is to use end mills, grinding them to the size or sizes that you are going to work, and then neck the mills about $\frac{3}{4}$ in. wide to a body dimension about $\frac{1}{4}$ in. from cutting end, as shown in the sketch. This gives a combination end mill and size plug. The procedure would be to spot and drill the holes, end ream the first hole using the end mill as a reamer, and put in a mandrel or size plug. Then when locating for the next and subsequent holes you can measure from the plug to the end mill, using the recess as a measuring point.

Taper-shank end mills must be used with collets to insure that the cutting tools will run true when changing from one size to another.

Fixture for Finding the Centers of Rods

By Arthur Kendall
Hamilton, Canada

A storekeeper whose time was much occupied in cutting rods of various sizes into even half-lengths, found the fixture shown in the illustration a useful and time-saving device. It consists of a piece of sheet metal, cut and bent as shown, and fastened to a wooden base by a couple of screws. The rod is laid on the hump in the center and is moved one way or the other until it balances. A pencil mark made on the bar over the center



Finding the center of a rod without measuring

of the hump shows where the cut is to be made. The center of the rod can be found by using this device in much less time than by measuring with a rule.

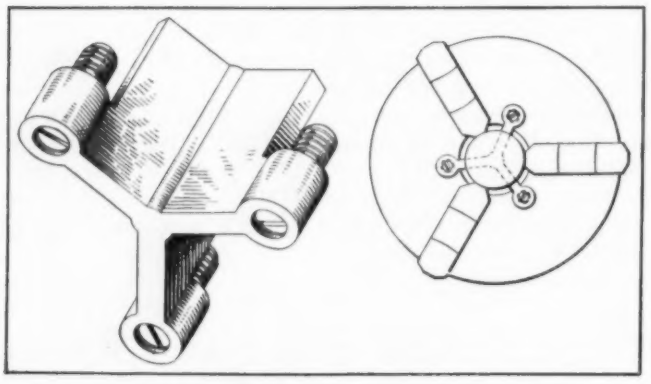
The rectangular cuts in the upturned ends of the device are to prevent the rods from swinging or sliding while being balanced.

An Adjustable Spacer for the Lathe Chuck

By Henry Simon
Jena, Germany

Difficulties are often encountered when facing off pieces of relatively large diameters and short length in the lathe, in providing a backing for the work that will align it and keep it securely aligned during the cut. A device I have found very successful is shown in the illustration.

The device is a small one-piece casting having three blade-shaped legs. The legs are formed in two steps, the rear portion being turned for a loose fit in the hole



Device for backing up short work in a chuck

through the chuck, while the front portion is enough larger to give a footing for the adjusting screws that bear against the face of the chuck.

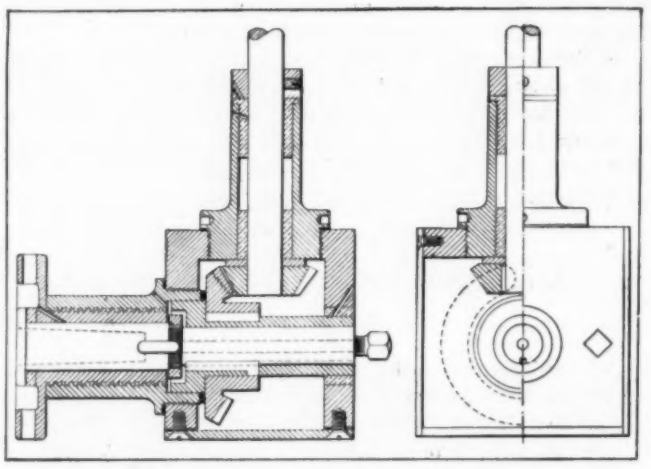
By this construction, adjustability for the thickness of the work is secured and the device is automatically centered and kept from sliding. It is also possible, by inserting screws in the front ends of two of the holes, to block up a piece having an irregular rear face. By using sets of screws of different lengths, a single spacer can be made to handle any job within the capacity of the chuck.

Attachment for Horizontal Drilling

By Herbert A. Trussell

The attachment shown in the illustration was designed for use on an ordinary drill press for drilling holes in the vertical webs of some large castings. It is cheaper to operate than an air or electric drill, and has the further advantage that the holes drilled with it are all in the same horizontal plane.

The housing is made of open-hearth steel and is easy to machine, being of a U-shaped section. The carrier for the horizontal spindle is internally threaded for the feed sleeve. This thread is left-hand so that in case the horizontal spindle should seize in the carrier, it will turn



An attachment for horizontal drilling

the feed sleeve and the drill will automatically be drawn from the hole.

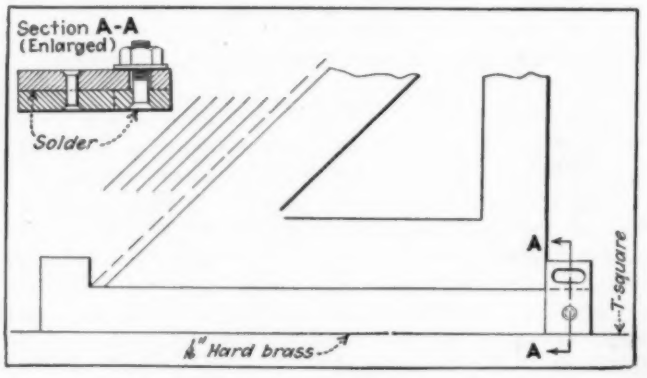
The drive shaft that connects the attachment to the spindle of the drill press, and the horizontal spindle, both run in brass bushings and are provided with fiber thrust-washers. Setscrews at the rear of the attachment can be brought to bear on any convenient surface, and serve the double purpose of a thrust for the attachment and also prevent it from revolving.

Spacer for Section Lining
Discussion

By C. W. Cornell

In an article under the title given above, on page 665, Vol. 67, of the *American Machinist*, Frank D. Smith, Jr. describes a spacer for section lining, the movement of which is limited by sight.

Herewith is a sketch of a simple section liner that is adjustable, the movement being controlled by stops. It is



An adjustable spacer for section lining

operated by the two first fingers of the left hand. The index finger rests on the spacer and the second one rests on the triangle. The spacer can be made to suit a triangle of any size. In operation, the device is fast and accurate.

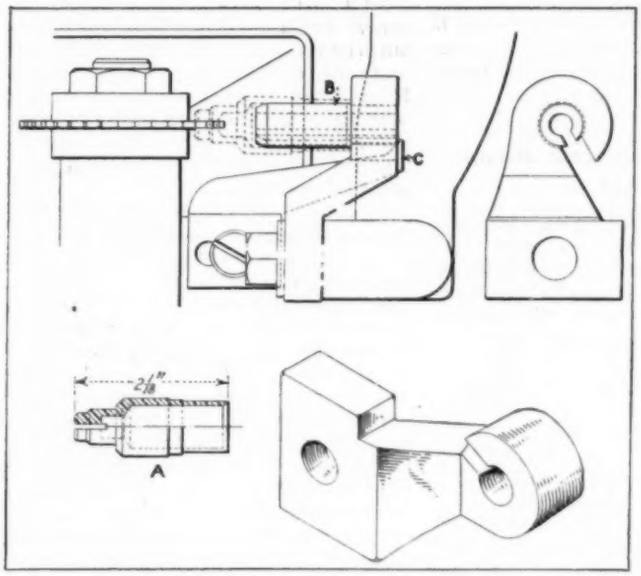
More and more sheet metal and plate work is being welded instead of riveted. The average saving is said to be about 25 per cent.

An Unusual Job of Slotting on a Screw Machine

By Henry Simon
Jena, Germany

How a job ordinarily considered beyond the capacity of the slotting attachment of a No. 2 B. & S. automatic was planned in a way that enabled it to be run on a production schedule, is shown in the illustration.

The work was the knurled steel-shell *A*, into the end of which a deep slot, $\frac{3}{32}$ in. wide, had to be cut. Because of the distance of the slot from the rear end of the product, and the requirement that it be centered within close limits, the logical way to hold the piece was from



Fixture for an unusual job of slotting

the inside, where the long reamed hole gave an excellent support. By this method however, the product would have to extend its entire length from the front face of the bushing, a distance of $2\frac{1}{16}$ inches.

The illustration shows the simple manner in which the job was handled, though it should be added that the regular advance-cam was replaced by another one giving a modified longitudinal movement. The regular bushing-holder was replaced by a special back-slung holder in which the tubular stud *B* is a force fit. Stud *B* was slit, the edges thus produced being left sharp in order to give a scraping action that would cause any small chips left in the reamed hole to accumulate in the opening of the stud, instead of becoming wedged between it and the product. The only other special part is the knockout finger *C*, and it may be added that to provide a thoroughly dependable way of removing the product from the stud, proved the biggest part of the job.

A knockout made like the regular type, and intended to give a straight push against the end of the piece had been planned. It was found, however, that though this caused the piece to slip right along until it was nearly off, at that moment the finger would cramp the product over and, in twenty-five times out of a hundred, would cause it to be wedged on the end of the stud.

A very slight change was made in the knockout, and consisted merely in beveling the tip to about a 45-deg. angle as shown. The lateral pressure developed by this angle proved sufficient to balance the cramping tendency.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Putting on a Leather Belt

Q. In putting on a single-ply belt, what is the right side to put next to the pulley. For twenty years I have used the smooth side next to the pulley at all times, but a book was brought before me that stated that the rough side should be used next to the pulley.

A. According to the practice in this country you are correct in your method of putting on the belt. The greatest stress or tension in the fibers of a driving belt comes on the outside, and as the rough, or "flesh," side is the stronger, it is natural to run the belt with the flesh side on the outside. Some are of the opinion, however, that the flesh side hugs the pulley better, and for that reason the flesh side is sometimes run next to the pulley. This is not the usual practice, however, in the majority of shops.

Wire of Very Small Diameter

Q. Can you tell me what is the diameter of the finest wire that can be obtained?

A. Drawn wire in almost any of the ductile metals can be obtained as fine as 0.0005 in. in diameter. However, special wires for instrument work are obtained in smaller diameters by what is known as the Wollaston method of drawing. A length of bare drawn wire is inserted into a tube of another metal, the tube and core being then treated as a single rod and drawn down to the required size. The outside metal is then dissolved off with an acid that does not affect the core. Wire of platinum as fine as 0.00005 in. in diameter has been drawn commercially by this method, while gold wire as fine as 0.00001 in. has been drawn. We do not have any record, however, of this method being employed for any wires other than those of the precious metals.

Fine wires of antimony and other materials lacking ductility have been drawn by the "Taylor process," which consists in melting the metal or alloy into a glass tube, and then drawing down the tube. Wire as fine as 0.00004 in. in diameter is drawn by this process. These fine wires are obtainable only in short lengths, but as they are used only in electrical instrument and laboratory work this is not ordinarily an objection.

Using the Lead Bath

Q. We have experienced difficulty with the sticking of lead to the tools in our lead hardening bath. We keep the bath covered with charcoal, which has helped somewhat. Can you advise how to eliminate this trouble?

A. A pure grade of lead, with no tin, is the first requirement for a hardening bath. The top of the molten metal must be cleaned frequently, and kept covered with fresh charcoal. The sides of the pot, just above the molten metal, should also be scraped clean every morning before starting work. With reasonably pure lead, and close attention to cleanliness you should have no trouble from the sticking of metal to the tools being heated in the lead bath.

Technical Abstracts

X-Rays Used to Improve Castings

The rays from an X-ray apparatus developed at the Watertown Arsenal penetrate 3½ inches of metal in thirty minutes. The X-ray method is used for detecting defects in castings that do not appear on the surface. From 75 to 90 per cent of the defects in castings are due to mistakes that occur in molding or in making the designs, and most of them are preventable.

The apparatus reveals cavities caused by gas and by water vapor due to wet sand in the mold, and also by shrinkage of the metal as it solidifies. Cavities caused by shrinkage occur because the design does not provide for a sufficient excess of molten metal in "risers," or enlarged portions, to compensate for the shrinkage. Cracks that do not appear on the surface of castings are also revealed. —*Machinery,* November.

Business Research Activities

The American Management Association has been conducting a survey of business research activities. A total of 174 letters have been received. Of those companies reporting, 138 have no separate department for carrying on research work; 14 have separate research departments which are more or less in the embryo stage; 22 have separate research departments carrying on extensive research work.

Of the 138 companies reporting no separate department for research work, nine indicate that extensive research work is being carried on by the different departmental organizations, 39 indicate that some research work is being done, while the remainder, or 90, appear to be doing no research work of a commercial nature.

A large number of the manufacturing concerns reported research departments for technical production problems only, while many of the insurance companies depend on trade associations for research work. The figures indicate that manufacturing concerns are just beginning to apply research methods to commercial work which have previously been applied to production problems.

Of the 22 companies reporting separate research departments doing extensive work, 12 indicated that the research department handles any company problem which requires impartial analysis. Eight companies placed the greatest emphasis on marketing problems, while 2 companies appeared to have divided their research attention between marketing problems and business conditions and economics work. None of the companies reported research departments with attention concentrated on organization, finance or personnel problems.

This condition appears to be representative of all companies reporting research work. Research departments are being developed which can handle any kind of business problem, but the greatest attention is being devoted to marketing work. The reports received do not contain enough detail to indicate the research methods employed. In most cases it appears that a research director has been appointed who acts as a separate staff officer.—*The Management Review,* December.

Group Bonus Is Important Factor in Delco-Remy Production

The wage payment plan in any organization is usually a very important one. We have a modification of the Bedeaux system which was first introduced at Remy about eight years ago. Since then it has been modified by applying it to groups of workers, in many cases, instead of to individuals. We believe in the group methods of wage payment where the work is naturally progressive and each man performs an operation on a piece which is passed to him from the preceding operator, and where the amount of work he can do is really limited by the number of pieces passing through the group.

The second class of work which we believe in grouping is where operators can actually help one another in their work, and where a more highly-skilled man can do the more difficult part of the work, and less-skilled operators can help in the group. The best example of this type of work is in the automatic screw-machine department. Our old method of handling our screw machine work consisted of having a setup man for each battery of machines. This setup man had no particular responsibility for the production and the operators, when a machine was in trouble, were allowed a certain amount for the machine being down. The result was a decreased production from the department and a general controversy between the setup man and the operators.

Our present system consists in grouping a setup man with the operators to cover a given number of machines, perhaps 15 or 20. The way the problem works out now, the setup man is paid a premium along with the operators on the total production from that group of machines. If the group operating these machines has a good bit of trouble, the operators will pitch in and try to get as many machines running as possible. Temporarily, one man may start five or six machines instead of the three machines which he would formerly operate.

Also in cases where we had day and night forces operating the same group of machines, the day and night men were included in the same group, so there was no controversy about who ran down the tools and who ground them and who spoiled the setups.

The improvement made in our production after this group system was satisfactorily working in our automatic screw machine department, was very surprising. The operators all made more money than they had ever made before; the capacity of the department was materially increased; and the quality of the work was also improved because there was no question about which group made it.

The third class of work which we believe in grouping is where the work is of such a nature that it is very difficult to keep track of the individual operations performed by the operators in that department. Our plating department is an example of this type of group work. The plating department operators are grouped and the total number of pounds of plated pieces are checked out of the department and standards are set on the basis of the total production from the department. It doesn't matter then whether a given operator is washing pieces or cleaning them or stacking them on racks, or what he happens to be doing, the men all pitch in and do whatever work is at hand to be done, knowing that if each does his part, they can all make money from the total production from that department.

There is another type of work which we have tried grouping, and which does not work out quite so well, an example being the generator armature winding. In this class of work, a number of operators are doing exactly the same operation. The time required for that operation is long enough that there is no difficulty in keeping track of the number of pieces produced by that operator. The only way we can group such operations with any satisfaction is to break the large group up into three or four smaller groups, keep track of the individual operators and classify them in the group they belong, depending upon the quantity of their production. In this way, the experienced operators are not penalized by the low production of the beginners. However, these groups, even then, are not nearly as satisfactory as the first three classes I described, and we only group this type of work when it is part of a big production setup and practically all other work is grouped, and then we group it from the point of view of the whole operation, rather than of the efficiency of that particular production in itself.—C. E. Wilson, *Automotive Industries,* Dec. 10.

Suggestion Systems for Employees

Experience of firms having successful suggestion systems shows that these systems are based on three fundamental principles: 1—To secure ideas valuable in the actual conduct of the business. 2—To arouse greater interest on the part of employees, and to secure their full co-operation. 3—To train men to think constructively along management lines with a view to filling more responsible positions. The basic idea of the suggestion system in the manufacturing plant is that the man on the job is the logical person to suggest improved methods for doing work. He has practical ideas for speeding up production, for new tools, new methods, and new safety devices, as well as ideas for increasing sales, and for better co-operation. A system whereby these ideas may be submitted, judged fairly, and the employees adequately rewarded, often results in net operating savings of considerable value.

Many firms have suggestion contests, during which suggestions are solicited for a limited time. Others carry on the suggestion idea continuously, and award prizes at definite intervals, or pay for all valuable suggestions received. It has been found that the contest is generally most successful in small plants, and that the system running throughout the year is better suited to large organizations. The disadvantage of the contest for the larger plant is that no award can be made until every individual case is investigated, and long delays are likely to result. Before launching either method it is necessary for the success of the plan to secure full co-operation of all executives and foremen. Any foreman who feels that suggestions coming from his men are a reflection on his administration can block the working of the system. Educational campaigns among the foremen are sometimes carried on, or prizes are given the foreman whose department contributes the most suggestions. For publicity purposes, and as an additional reward, one large factory in the Middle West gives an annual suggestion banquet to which all successful suggestors for the year are invited.

In order that employees may have a definite understanding as to what kind of suggestions are wanted, and to prevent the submission of a great volume of futile ideas, a concrete plan must be formulated. One large production plant, which is typical, requested suggestions during 1927 on a list of eleven items.

Other firms limit the nature of the suggestions. Some companies confine the suggestions to safety, while one plant requests only suggestions on new products. Another manufacturing plant eliminates irrelevant and half-baked ideas by limiting the quality. If an idea is not worth more than two or three dollars it is not desired at all. Finally, other companies do not limit the scope of suggestions, but stress certain subjects that are most needed at the time.

In most cases, all employees, with the exception of the supervisory force, are eligible to compete in the suggestion system. Some companies then hold contests for the supervisory force only. A few companies open their suggestion systems to all paid employees, including the officers of the company. One plant that is a pioneer in the paid suggestion idea, has never excluded foremen, and has obtained some of the best ideas from them.

The best method of paying for suggestions has been found to be to measure the actual value, and to scale the rewards accordingly. This plan is being widely adopted, and the older system of fixed prizes is being abandoned. Where contests are employed, prizes varying in amounts from one dollar to several hundred dollars are given. Where ideas cannot be measured in terms of money, arbitrary awards are made. In one large electric company the awards are usually 10 per cent of the estimated first year's savings, but if an improvement in product is also involved the percentage may be increased. A watch company pays money awards on a scale from $5 to $500, more than 60 per cent of the awards during 1926 falling in the $5 class, and only one in the $100, and one in the $500 class.

A toy company awards $250 a year for five years for any new toy that is successfully manufactured for that length of time. Besides the individual prizes, some companies offer annual prizes for the best suggestion of the year, or for the largest number of suggestions from one employee during the year. These capital prizes vary over a wide range from $5 to $500, depending upon the original basis of award and the size of the plant.

The success of the suggestion system is dependent upon the conviction of the employees that it affords them a square deal through a careful and fair estimate of the suggestions. All suggestions should be acknowledged upon receipt. If suggestions are rejected, the originator should be given the reason.

Most companies with successful suggestion systems have committees who take the suggestions as they come from the suggestion boxes, and investigate the problems involved. Sufficient clerical help is provided to acknowledge the receipt and to keep the records. One large electrical plant has a general committee, which includes the head of the testing department, the supervisor of research, a general foreman, and a secretary. Another plant has a suggestion manager who has eighteen departmental committees of three members each, to which he refers the suggestions.

Encouraging the employee to think in terms of management is good training for positions of greater responsibility. Any firm whose policy it is to fill higher positions from the ranks will find a suggestion system an incentive to the employees, and a guide to eligibility for advancement. It has also been found to be the means of locating men in the organization for research and development work.

For the data given we are largely indebted to the Metropolitan Life Insurance Company

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Saving a Thousand Men's Eyes

SAFETY campaigns have done much to preserve eyesight and to prevent other serious injuries. As a rule the wearing of goggles has been confined to such occupations as grinding, chipping and similar work and it has not been easy to enforce their use even here.

The Pullman Company has gone a long step farther. Every employee in the repair shops and yards of the company is required to wear goggles at all times while on the job. The result, according to the director of safety, has been to save the eyes of approximately a thousand men.

Many workers resent the wearing of goggles even in what we consider the more dangerous occupations, but there is no question as to the necessity of compelling their use in such places. It may even be advisable to follow the Pullman Company and insist on their use all through the shops, but it would be well to consider the whole situation carefully, as some classes of work hardly seem to require such protection.

Greater attention to making goggles more comfortable to wear would probably assist in their general adoption.

Bringing the Industrial Museum Idea to America

THE trustees of the museums of the peaceful arts in the city of New York have done an important service to American Industry in having made a film that shows convincingly the scope and methods of the great industrial museums of Europe. Ever since the war, the idea of industrial museums here has received a great deal of attention. At least three projects are being actively agitated, a museum for Washington, one for New York, and one for Chicago. However, very few men, be they engineers, industrialists or laymen, have had any adequate idea of what an industrial museum is or can be or can accomplish. One has to see in order to appreciate the interesting potentialities .

Therefore, the trustees did the best thing they could to bring the four great European museums —of London, Paris, Munich, and Vienna—to America; they have had the buildings, the exhibit halls, and individual exhibits carefully filmed and put together in an interesting and attention-holding display.

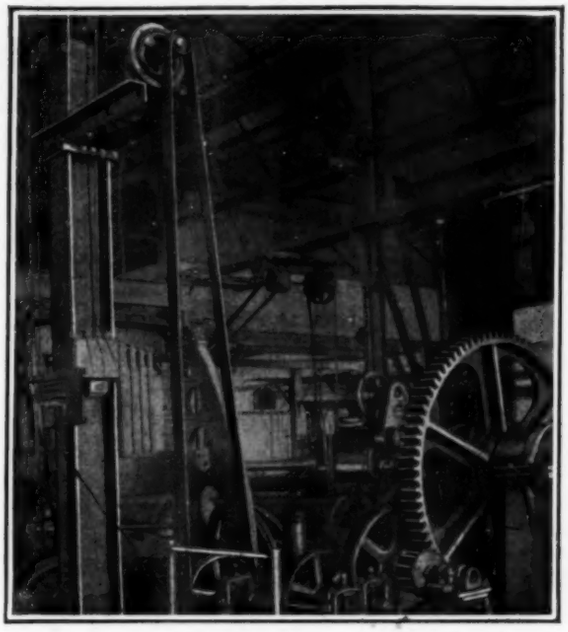
Unquestionably, the liberal showing of the film in the United States will promote not only the idea of a museum at New York, but will stimulate the other two projects and may stir up desires for similar institutions at other points. That these museums can be great popular institutions for education in industrial methods, processes and problems there can be no doubt. The statement of Mr. Charles T. Gwynne, vice-president of the Chamber of Commerce of the State of New York, under whose personal direction the film was made, that in this industrial and scientific age such a museum will attract a greater attendance than art or natural history exhibits, is undoubtedly true. Certainly, the experience of the four European cities where museums now exist proves this to be the case. Engineering and industry will be the better for a broader understanding by the public at large of their progress, achievements, methods and processes.

Reducing Idle Time of Machines

THE effect of machine design on maintenance was recently brought out in an interesting manner. In discussing ball and roller bearings it was pointed out that the reason for a firm's insisting on their use was not because of any saving in power, but because of the maintenance cost. While anti-friction bearings are more expensive than plain bearings, the ease with which they can be replaced made them desirable.

Realizing that the machine earns dividends by continuing production, this user is willing to pay the higher price of the anti-friction bearing in order to lessen the idle time when repairs are necessary. This is a point for designers to consider in other parts of the mechanism. Whatever will decrease idle hours per year is a real asset to any machine.

For true economy, however, the maintenance cost must be considered in connection with other factors. If, for example, a bearing, gear or other part is not as efficient as some other design, the ease of repair above should not be the only deciding factor. Should it happen that a method of construction which took a little longer to repair saved a second out of every minute, or a minute an hour, it can easily be calculated when the replacement time ceases to be the controlling factor in the equation.



A Repair Shop in Cuba

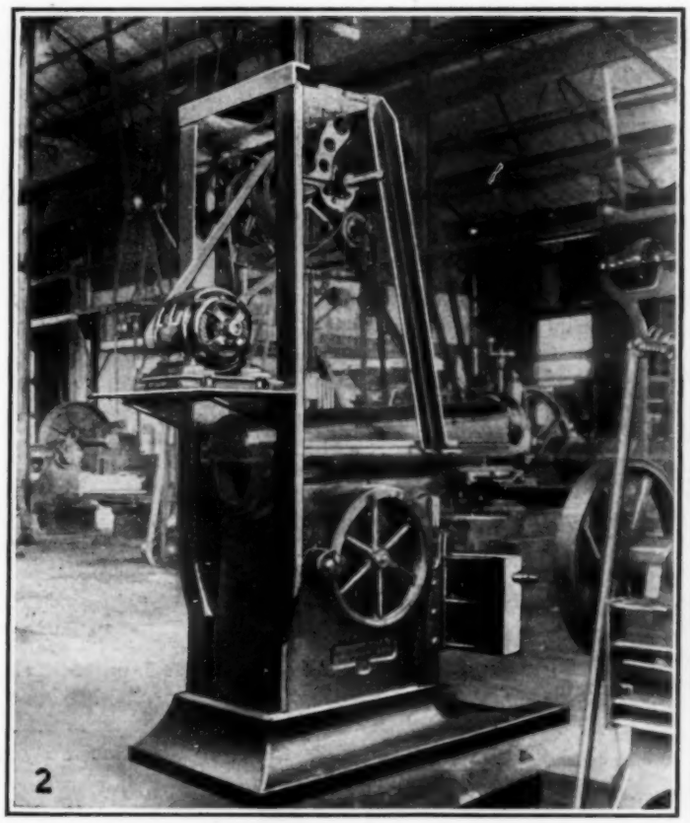
By Fred H. Colvin
Editor, American Machinist

Applying individual motor drives to old machines—Using the torch for cutting and welding sewer gratings—Unusual but convenient pattern storage method

Fig. 1—Triple-reduction drive from motor

AT CASA BLANCA, just across the bay from Havana, Cuba, is the "talleres" or machine shop of the Vda. de Ruiz de Gamiz, and which handles repairs to sugar mills and other machinery. It is an old established institution, that is however, keeping up-to-date both as to equipment and methods, so far as conditions warrant.

Among other improvements is the introduction of motor drives to a number of the machines, two applications being shown in Figs. 1 and 2. In the first instance



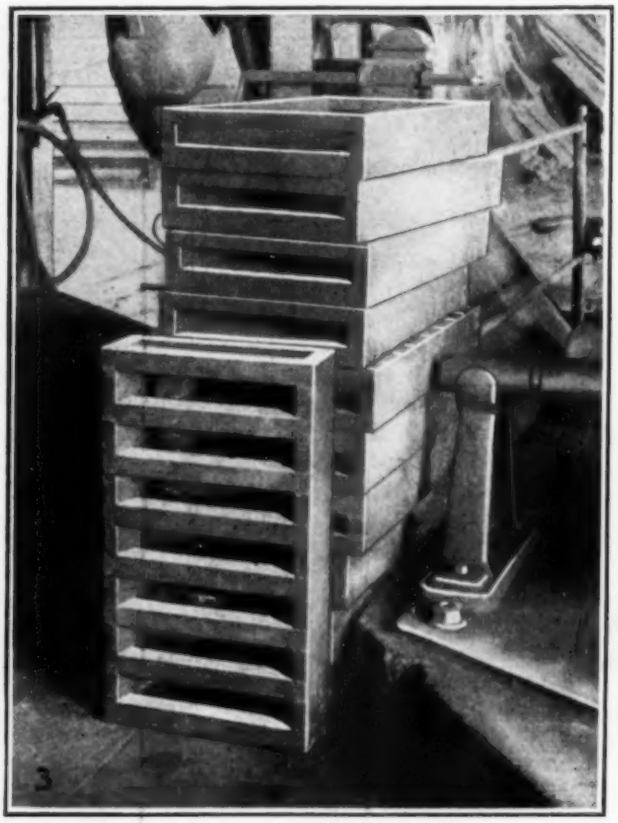
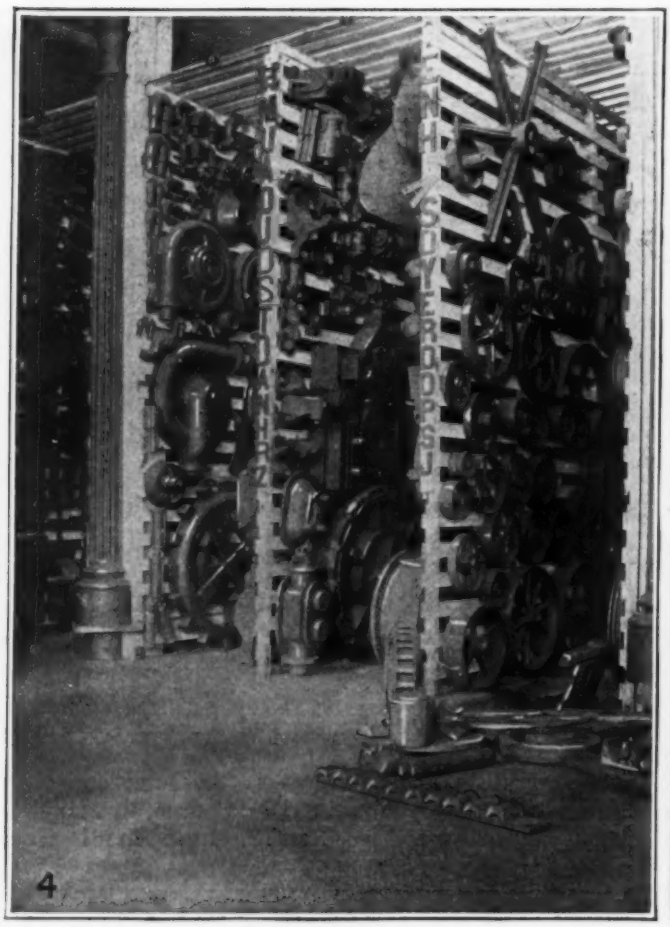


Fig. 2—Motor mounted on shaper. This view shows the framework built up of angle iron for the most part, and the completed frame fastened to the shaper bed by capscrews. The frame itself is built up by welding, as can be seen at the joint at the top and also where the shelf or bracket for the motor is fastened to the front upright. The motor drives a small countershaft, the driving belt to the shaper pulley coming down on the other side of the machine. Fig. 3—Frame-welded sewer grating. An unusual manufacturing job in which the openings for the cross bars are cut out with a torch and the gratings welded in place in each side bar. There is also a reinforcing strip at the end of each side bar, as can be plainly seen on the top grating



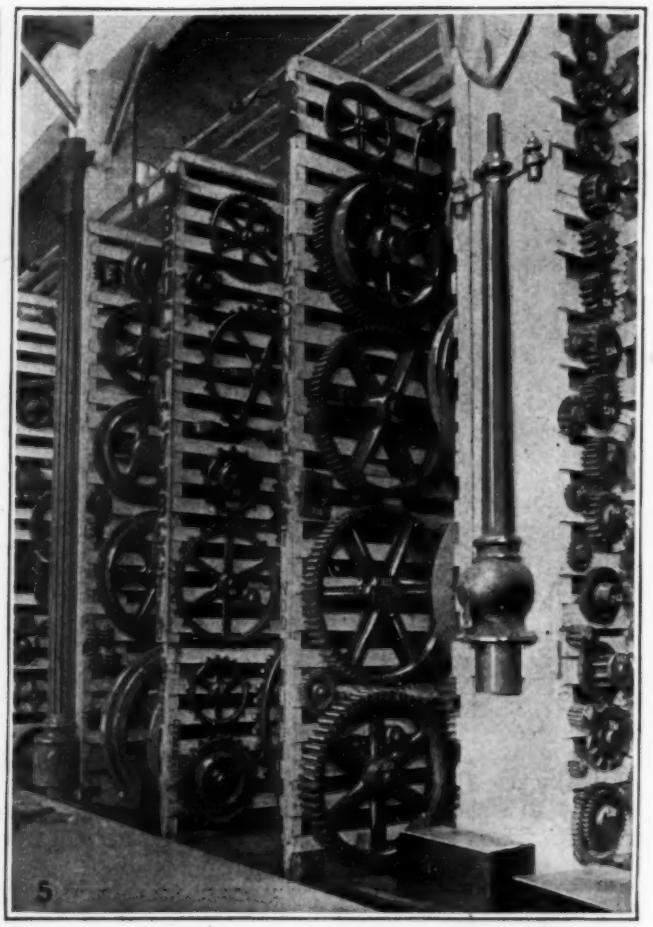


Fig. 4—Storage rack for pulley and other patterns. This view shows an unusual method of storing patterns on vertical partitions that are built up by upright and horizontal strips. The patterns are all numbered and since they are readily visible, it is extremely easy to pick out the one wanted without difficulty. Fig. 5—The same method used for gear sprocket and other patterns. This view shows how the same idea can be used for a great variety of pattern shapes. It also gives a better idea of the accessibility of each pattern, and shows the construction of the racks or partitions and how they are fastened together at the top. Tall patterns, such as lamp-posts and columns, are hung on the ends of the partitions and are readily accessible

the motor is mounted on a pair of angles fastened to one of the columns. The drive is by belt and by triple gear reduction and is shown in Fig. 1. Another application is seen in Fig. 2 where the motor for the shaper is mounted on the framework built up on the shaper itself. While the frame is bolted to the shaper, the parts forming the frame are welded together, welding being used freely in this shop.

An application of the use of welding in commercial work is seen in Fig. 3. The pieces being welded are sewer gratings for the city of Havana, being used in places where traffic is heavy and where the trucking breaks the regular cast-iron gratings. The grates are 14x25 in. and are built up of bar steel. The side pieces are 1x4 in. and are cut out with a torch to receive the cross-bars, which are 1¼ in. square. These bars are then welded in place, making the whole grating a solid unit. A small tie-bar is then welded across the lower ends of the side bars as shown in the top grating.

As with all old established machine shops doing a large variety of work, there is an accumulation of patterns of many kinds, shapes and sizes. Many of them are for gears, as shown in Fig. 5. The method of storing the patterns is different from that usually found, and permits easy access, as well as enabling the entire pattern stock to be readily seen, almost at a glance. All the patterns are numbered, however, and the locations are filed on a card index. This method of storing allows a circulation of air around the patterns and there is no tendency for them to warp.

The usefulness of this method is not confined to gears and pulleys as can be seen in Fig. 4 where patterns for centrifugal pumps and other patterns of many shapes and sizes, are stored in the same way. The racks are easily made and, when painted white, are both attractive and convenient. Pattern letters and long, slim patterns, such as lamp posts, are kept at the ends of the racks.

Thirty-Five Years Ago

THE Lodge and Shipley Machine Tool Company recently machined on its 30-in. turret lathe a cast-steel blank 23 in. in diameter, 4½-in. face, 3⅝-in. bore, and hub 7½ in. long, in 45 minutes. This, they believe, is a good day's work for a powerful engine lathe.

There can be no doubt that the present vast demand for bicycles will cause the greatest imaginable advance in machine tools.

The Cleveland Twist Drill Company has just had the honor of furnishing the celebrated cruiser Columbia with a full complement of twist drills and tools.

Shop Equipment News

Norton 6x10x36-Inch Hydraulic Surface Grinding Machine

RADICAL improvements have been made by the Norton Company, Worcester, Mass., on the open-side surface grinding machine previously described on page 979, Vol. 56, of the *American Machinist*. The principal features are the hydraulic table traverse and the two lengths of table in which the machine is furnished. The base is longer and is the same length on the floor as the table ways. It is designed to carry two lengths of table, one provided for grinding work up to 36 in. and the other for work up to 48 in. in length. Finished pads on the top surface of the table are machined with T-slots for conveniently mounting magnetic chucks of these lengths.

The hydraulic mechanism for traversing the table is entirely inclosed within the base, but is accessible for adjustment through two doors in the front of the machine as shown in Fig. 1. All movements of the table are controlled by the two levers shown between the base doors. The upper lever is used for reversing the table motion, either by hand or automatically at the end of the stroke, and is regulated by dogs on the table.

Two dogs are provided at the right end of the table; one is for setting the stroke to correspond with the length of work ground, and the other is a stop for locating the table in the same position relative to the grinding wheel, for truing. When the reverse lever is pulled out, the first dog is passed and the lever is tripped by the second dog, which it cannot pass.

The lower lever controls the speed of the table traverse and can also be used to stop the table motion, although the reverse lever will also stop the table motion when moved to its central position without disturbing the setting for the desired table speed. The speeds can be varied from 30 to 90 ft. per min. Air cushions are used in the hydraulic system to allow smooth reversal at high speeds.

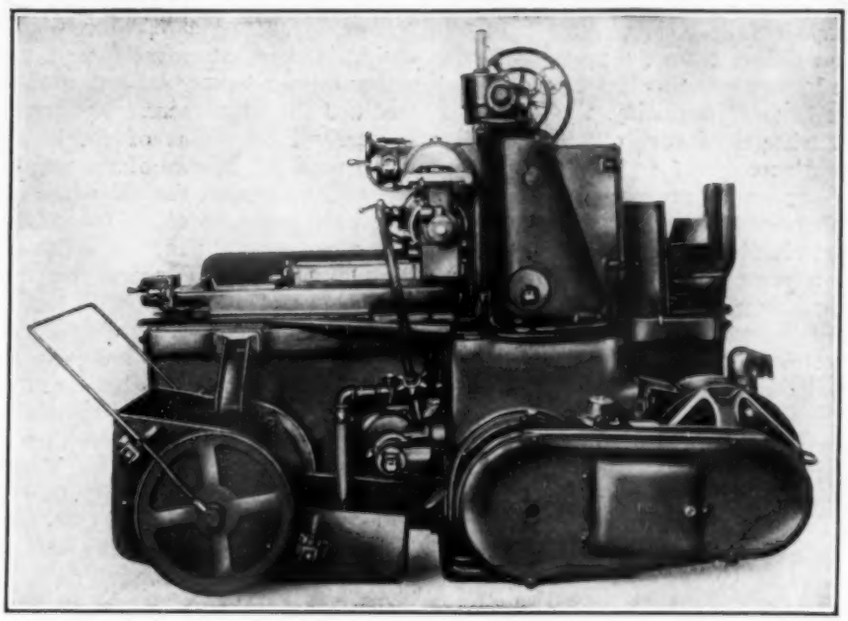


Fig. 2—Rear view of the Norton Surface Grinding Machine

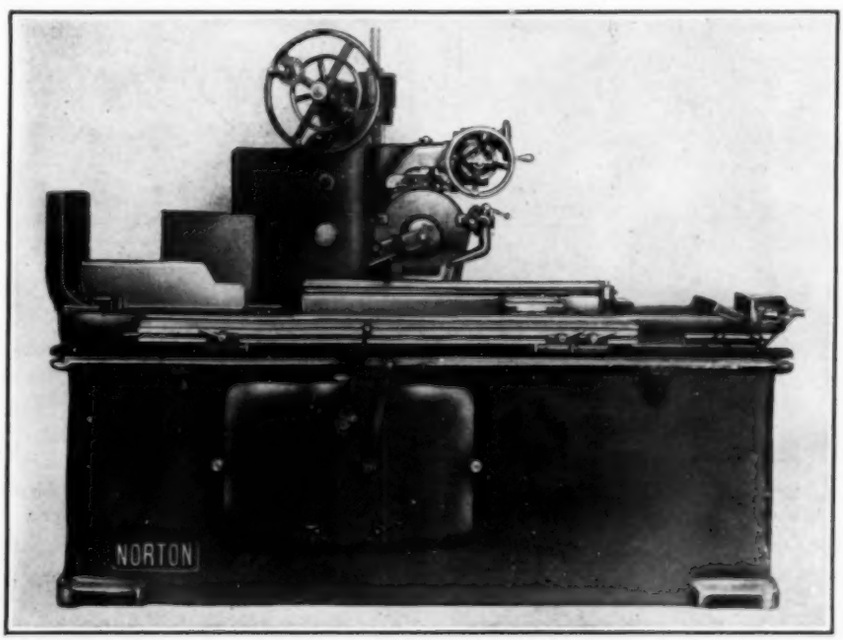


Fig. 1—Norton 6x10x36-Inch Hydraulic Surface Grinding Machine

Many features of the old machine are retained in this model, including the flood-lubricated grinding wheel spindle with bearings that can be adjusted while the spindle is running. As before, the cross feed of the wheel slide is controlled by means of two handwheels, one for regular operation and the other for slow motion while truing. Graduations down to 0.00025 in. are provided on the vertical wheel feed. Splash guards running the entire length of the table are provided as shown.

A standard 15-hp. constant-speed motor, bolted to the rear of the base, furnishes power for both the spindle and hydraulic table traverse. The standard grinding wheel used is 10 x

Shop Equipment News

3 in. and is counterbored to take flanges 5¼ in. in diameter.

The projected floor space occupied by the two models are 12 and 13 ft., respectively, by 64 in. deep. The length of base for either machine is 8 feet, while the weights are 7,300 and 7,400 lb., respectively.

Olsen-Lundgren Centrifugal Dynamic Balancing Machine

THE Olsen-Lundgren centrifugal dynamic balancing machine illustrated is being placed on the market by the Tinius Olsen Testing Machine Company, 500 North Twelfth St., Philadelphia, Pa. The machine is made in various sizes to suit the work, and differs from the previous model in having two stands for holding the work and measuring the effect of centrifugal force caused by the unbalance.

The stands are provided with two rollers each, on which the work rests and revolves. Behind each stand is a stop pivot which controls the backward movement of the stand, while any forward movement causes an electrical contact to be made, which is transferred through a high-tension vibrating coil to the dial indicator at the right of the machine.

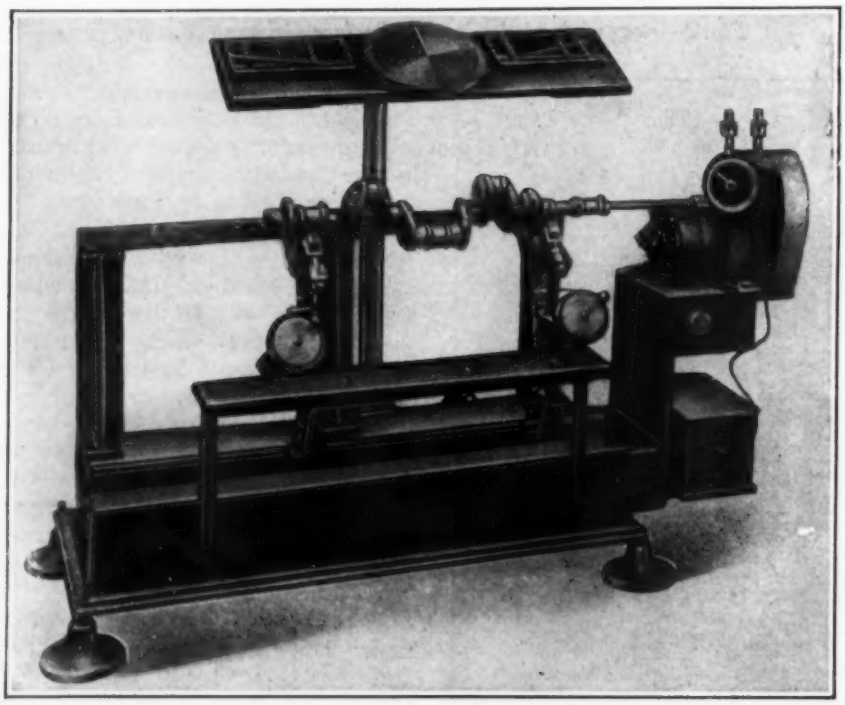
If an unbalance occurs in the work being tested the centrifugal force throws the front rollers forward, making electrical contact, which is then indicated by the pointer on the dial. As the sparks continue between the pointer and the dial for the whole period of unbalance the angle of the plane of unbalance is shown with accuracy.

For determining the amount of unbalance in ounce-inches a screw and weight is provided on each stand, together with a handwheel and graduated dial for adjustment. The screw is revolved by means of the handwheel until the balance of the weight offsets the force of the unbalance of the shaft being tested. This condition of adjusted balance is indicated by the cessation of sparks on the sparking dial. When the sparks cease, the amount of unbalance can be read directly in ounce-inches from the dials on the handwheels, since the amount shown is the force in ounce-inches necessary to place the test piece in correct balance.

The test piece is driven from the drive shaft by means of a universal coupling. The drive shaft is revolved at a designated standard speed through reduction gears from a motor. In the case of the No. 3 size machine used for automobile crankshafts the motor is of ½ hp. Machines of other sizes will be furnished to meet any given condition of work testing. Each machine size is adapted for various lengths and diameters of work between given ranges, as the position of the work stands are adjustable for length, and the rollers are adjustable for diameter of work by means of micrometer screws.

The movement of the unbalance force is confined to such a small minimum that it is not appreciably affected by the speed, and the critical speed does not, therefore, enter into the calculation. For light work a standard speed of 265 r.p.m. is used, giving a pressure of four times the actual unbalance. For heavy work half speed is used, giving the direct rate of unbalance.

The machine is claimed to be rapid in operation, since the positioning of the work requires only connection with the universal coupling, and all readings are direct. The readings are taken in two planes on the work, usually the bearing positions in the case of shafts. For transferring these readings to any other position of the work, two direct-reading transfer instruments are furnished, one for each stand. These are shown at the top of the illustration. The universal machine also includes an instrument for the direct reading of the resultant unbalance of two unbalances occurring in the rotor at different angles and of different amounts. The instrument gives the resultant shaft unbalance in ounce-inches as well as its angle. Any specified graduation other than ounce-inches can also be furnished on the dials and instruments.



Olsen-Lundgren Centrifugal Dynamic Balancing Machine

Kelly Diamond Boring Tools

Diamond boring tools for automotive use were recently developed by the Kelly Reamer Company, Cleveland, Ohio. The two borers shown in the illustrations are for finishing camshaft and for crankshaft bores for automobiles.

Because of the type of cutter employed and the accuracy to be maintained, a special unit was developed to hold the diamonds, known as the Kelly-Howard rotor unit. The tools

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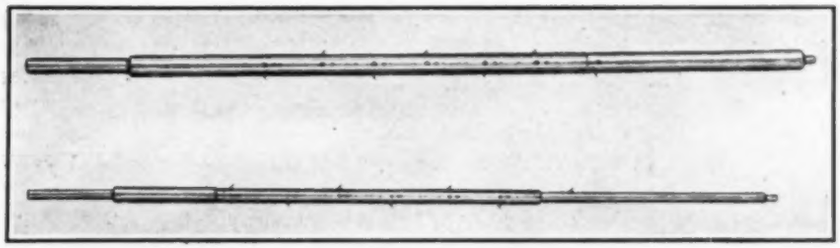


Kelly Diamond Boring Tools

are withdrawn into the bar so that it can be inserted in the fixture without interference. The diamonds are then brought out to the cutting position, and the construction of the tool is such that the maximum tolerance does not exceed 0.0002 in. In this position the bar is in static balance so as to eliminate any tendency of the tool to be thrown into the bearings at high rotational speed and thus cause quick wear of the diamonds.

The bars are made of heat-treated alloy steel and all parts of the bar are self-contained. A new type of inserted strip pilot, designed for long life, is featured.

EC&M Inclosed Type ZO Across-the-Line Starting Switches

The Electric Controller & Manufacturing Company, Cleveland, Ohio, is now supplying its standard Type ZO across-the-line starting switches, for small a.c. motors, in iron-clad tanks, in order to make them suitable for operation in atmospheres where acid fumes are present. Like the standard EC&M type switches, all of the contacts, including the overload trip, open and close under oil, so that this starter is flameproof. There is a machined fit between the cast-iron cover and the tank, thus making the starter rainproof.

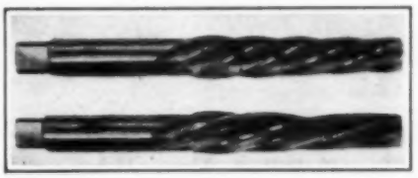
Phantom view of an EC&M Inclosed Type ZO Across-the-Line Starting Switch

Manchester "Rapid Cut" Taper Reamer

A helical-fluted taper reamer in which the helix angle of the cutting edges varies between flutes has been brought out by the Manchester Tool Company, Manchester, Conn. This peculiar disposition of the flutes has the apparent effect of producing a reamer with a greater number of flutes at the ends than at a point midway between them.

For instance, in a reamer having nominally six flutes there will be that number at both the large and the small ends, yet in counting around the body in the middle of the cutting portion but five flutes can be found. The blending is such that no distortion is apparent.

The claim made for this type of reamer is that the different helix angles at which the several blades are disposed effectually forestalls tendency to chatter, and that only smooth holes can result. The peculiar feature of the reamer does not complicate the matter of resharpening; it may be ground on centers, supported by a finger-rest, in any of the ordinary toolroom equipment provided for reamer grinding. The actual number of cutting edges to be ground is dependent upon the size of the reamer.



Manchester "Rapid Cut" taper reamers

These reamers are made in pairs, each pair including a finishing reamer of this type and a roughing reamer of the same size with uniform helix angle and with blades nicked at intervals to break up the chips. They are furnished in all standard sizes of Brown & Sharpe, Morse or Jarno taper, and with squared, round or tapered shanks. In all reamers the helix is laid on left-hand.

Sullivan Vertical Air Compressors of Small Capacity

FOR shop, power plant and miscellaneous industrial requirements in which a relatively small amount of compressed air is needed, and where compactness, continuous operation and practically automatic control are important factors, the Sullivan Machinery Company, 128 South Michigan Ave., Chicago, Ill., has designed two vertical direct motor-driven air compressors of the two-cylinder and four-cylinder types. Both machines are single acting and similar in design to the portable air compressor units made by this company.

In the two-cylinder machine, Fig. 1, the cylinders are cast in one block and bolted to the crankcase, and the one-piece cylinder head is bolted to the top of the block. Baffles below the open end of the cylinder prevent oil from being thrown into the cylinder. The Wafer valves for both inlet and discharge are placed in recesses of the cylinder head and are accessible by means of removable covers. An air filter is attached to the intake opening. The steel shaft has two cranks, 180 deg. apart, with opposed counterweights to balance the inertia effects of the reciprocating parts. A combination breather and strainer is mounted at one end of the case. The rim of the flywheel dips into a pool of oil in the well and throws this oil upon the crankshaft bearing nearest to the wheel and into

Shop Equipment News

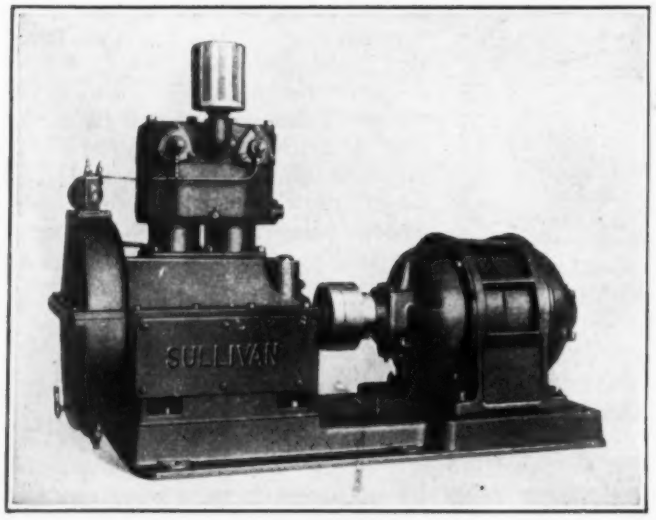


Fig. 1—Sullivan Vertical Two-Cylinder, Motor-Driven Air Compressor of 120-cu.ft. capacity

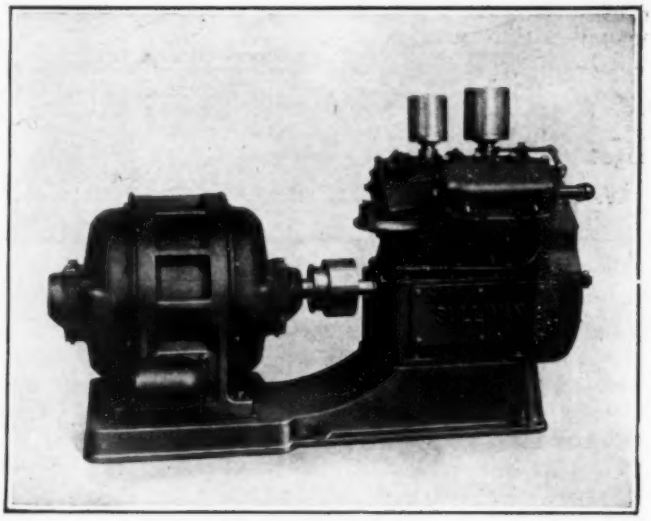


Fig. 2—Sullivan V-Type Four-Cylinder, Motor-Driven Air Compressor of 240-cu.ft. capacity

a channel, by means of which the oil is conducted to the other bearing.

The four-cylinder vertical compressor is a new departure in design. Instead of using two large cylinders, this model employs four of a proportionately smaller size. The cylinders are placed in pairs at an angle of 90 deg. with each other, forming the V-type arrangement shown in Fig. 2. The two connecting rods for opposite cylinders are attached side by side on one crankpin so that only two cranks are required for the four cylinders. The shaft is but slightly longer than that used in a conventional two-cylinder machine and requires the same number of bearings for its support. Other features of the design are similar to those of the two-cylinder compressor. The speeds of the two machines are the same, and the capacities 120 and 240 cu.ft. of free air per min., respectively.

Direct- and alternating-current motors, together with control equipment for hand starting and stopping or for full automatic control, are available. Automatic control of the compressor cooling water also may be arranged.

Stuebing Cowan "Red Streak" Ball-Bearing Lift Truck

Ball bearings on the wheels are featured in the "Red Streak" single side lift trucks, made by the Stuebing Cowan Company, Cincinnati, Ohio. Eight heavy-duty ball bearings are used, two to each wheel. The truck shown will handle loads up to 5,000 lb. Because of the application of ball bearings, much less effort is required to start the load and to keep it moving.

Stuebing Cowan "Red Streak" Lift Truck

Trade Catalogs

ACETYLENE GENERATORS. The Alexander Milburn Co., Baltimore, Md., describes in bulletin B-200C its acetylene generators for use with oxy-acetylene welding and cutting apparatus. Three of the types are illustrated. Complete specifications are given.

GENERAL ELECTRIC PUBLICATIONS. Several bulletins perforated for insertion in a loose-leaf folder have been issued by the General Electric Company, Schenectady, N. Y. Bulletin GEA-37B treats of direct-heat electric furnaces, types AD, RRB, and RRC. Other bulletins cover the following apparatus: 528A, centrifugal air compressors; 801, electrically-heated oil temperating baths; 822, ball bearing construction as used in a.c. and d.c. general-purpose motors; 827, capacitors for power-factor correction; 833, d.c. printing-press controllers; 834, controllers for a.c. slip-ring induction motor; 849, magnet frames for railway and industrial haulage motors; and 853, a discussion of solid versus split gears for railway and industrial haulage motors. The descriptive treatment in all cases is technical in character. All bulletins are well illustrated with photographs.

GRINDERS, SURFACE. The Blanchard Machine Co., 64 State St., Cambridge, Mass., has published Form 55 on its automatic No. 16-A surface grinder. A general description of the machine is first given, followed by detailed descriptions of various types, such as the hand-loading, magazine-loading, and dial-loading types. Fixtures having automatic clamping features are also discussed. Each type is illustrated with several photographs of typical applications. The demagnetizer and washing attachment are also described. Complete specifications are given.

GRINDERS, UNIVERSAL AND TOOLROOM. The Oesterlein Machine Co., Cincinnati, Ohio, has issued a catalog on its new Nos. 2 and 3 cutter grinders. The design features of both machines are first pointed out, followed by specific descriptions of each size. Both motor-driven and belt-driven models are described and complete specifications are given. Considerable space is devoted to instruction in sharpening face mills, end

Shop Equipment News

mills, side or straddle mills, and saws, and the grinding of formed cutters, plain mills and reamers. Various other forms of grinding are also treated. The catalog is well illustrated throughout, largely with photographs. It contains sixteen pages.

MATERIAL - HANDLING EQUIPMENT. The Barrett-Cravens Co., 1326 W. Monroe St., Chicago, Ill., has available for distribution a broadcast containing over 75 pictures of installations of lift-trucks, portable elevators, barrel trucks and hoists. All the pictures show the equipment in actual operation.

METALLOGRAPHIC EQUIPMENT. The Bausch & Lomb Optical Co., Rochester, N. Y., has issued a booklet on its large metallographic equipment. The publication contains 32 6x9-in. pages, and is well-illustrated throughout. A very complete and detailed description of the apparatus used in making micro-photographs of metal specimens is given. Complete specifications and prices are appended.

MOTORS. The Crocker-Wheeler Electric Manufacturing Co., Ampere, N. J., has issued a leaflet describing its Form "H" direct-current motors, 3 to 100 hp. The chief characteristics of this line of motors is stressed with the aid of photographs of the principal parts. Several applications of the motor are also illustrated.

MILLING MACHINES. The Kearney & Trecker Corporation, Milwaukee, Wis., has published a descriptive circular on its new Mil-waukee-Mil, an advanced type of production milling machine made in two types, a Simplex and a Duplex type. The constructional features are pointed out and complete specifications are given. The circular is illustrated.

NICKEL IN CAST IRON. The International Nickel Co., 67 Wall St., New York, N. Y., has published a four-page bulletin entitled "Alloy Cast Iron Meets High-Duty Requirements." It is a practical, non-technical description of the improved physical properties secured by the addition of Grade "F" nickel to gray cast iron, with a tabulation of the physical and mechanical characteristics of the alloy iron as determined by laboratory investigations and tests. The company has also prepared a wall chart of instructions for adding nickel and chromium to cast iron, either in the ladle or in the cupola. The instructions are printed on a substantial grade of cardboard, and on the back is a reference covering the types of castings for which alloy additions are recommended.

"NITRALLOY." The Ludlum Steel Co., Watervliet, N. Y., has prepared a bulletin on "Nitralloy" steels of special analysis for use in the nitriding process, wherein the surface is hardened at a low temperature by the action of ammonia. Physical properties of the various grades of Nitralloy are given in both tabular and graphical form. The nitriding process is described and the results obtained analyzed. The treatment is entirely technical in character.

OIL BURNERS. The Alexander Milburn Co., Baltimore, Md., has issued bulletin B-200D on its oil burners and preheaters. Type A for use with compressed air and type B for use with a portable hand pump are presented. The bulletin contains four pages and is illustrated.

PRESSES. The Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J., has prepared a treatise on the production of hot-pressed brass parts. The advantages of the patent percussion power presses made by this company for performing this type of work are brought out. One of the presses is illustrated as are several samples of the work performed. The publication contains four pages, 8½x11 in. in size.

REAMERS. The Foster - Johnson Reamer Co., Elkhart, Ind., has available for distribution a two-page circular describing its general-purpose reamers. Several examples of work handled by these reamers are illustrated.

SCRAPER, POWER. The Anderson Bros. Mfg. Co., Rockford, Ill., has published a catalog on its power scraper and ball bearing turntable for use in conjunction with this machine. The various features are described and illustrated. Several photographs show the machine in actual use. The publication contains eight 8½x11-in. pages.

SLEDGE, MECHANICAL. The Chambersburg Engineering Co., Chambersburg, Pa., has prepared a circular on its mechanical sledge. The machine is illustrated by several photographs and some typical operations are indicated.

TRANSMISSION MACHINERY. The A. Plamondon Division of Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has issued catalog No. 68 on its products. The publication contains 192 5½x7¾-in. pages and is illustrated with both drawings and photographs. The line includes heavy gearing, friction clutches, shafting, pulleys, hangers, couplings, collars, pillow blocks, wormwheels, flywheels, and rope sheaves. Complete tables of ratings of friction clutch pulleys and complete price lists, of all possible sizes of machine molded pulleys are presented. Much tabulated information is also given for spur and bevel gears, as well as spur mortised and bevel mortised gears. In fact, the greater part of the book is devoted to this type of data.

WOODWORKING MACHINERY. The Oliver Machinery Co., Grand Rapids, Mich., describes in catalog No. 24 its Junior line of woodworking machinery. This line of portable machinery includes a 7-in. tilting arbor saw bench, 18-in. band sawing machine, electric band saw brazer, jointers, hollow chisel mortiser, oilstone tool grinder, motor bench grinder, wood trimmer, 15-in. disk sander, vises, clamps, glue pots, and heaters. The catalog is well illustrated throughout.

Pamphlets Received

AERONAUTIC TRADE DIRECTORY. Information bulletin No. 3, third edition, published by the Department of Commerce, Office of Assistant Secretary for Aeronautics, Air Information Division, Washington, D. C., is divided into two parts. Part I lists manufacturers of commodities, and Part II operating companies. The commodity manufacturers are classified according to product, such as airplanes, engines, etc. The operators are classified according to mail service, taxi, sightseeing, delivery, and the like. Aeronautical engineers, and instruction schools and instructors are also listed.

ALLOY STEEL. Bulletin No. 11, entitled "Notes on Machining Alloy Steel," published by the International Nickel Co., 67 Wall St., New York, N. Y., presents data developed from research demonstrating that under conditions of properly controlled shop practice, nickel steel may be more readily machined than carbon or other alloy steels of the same tensile strength. The relative machinability of alloy and carbon steels is dealt with in considerable detail. The treatment is technical in character and is amplified by charts.

BUSINESS STATISTICS. The United States Census Bureau is issuing a record book of business statistics which is being prepared in sections, each of which covers a major industry and presents monthly data from 1909 to 1926. The textile section has already been published and may be obtained from the Superintendent of Documents, Washington, D. C., at 10 cents a copy.

RESEARCH IN NEW ENGLAND. The Metropolitan Life Insurance Co., Policyholders' Service Bureau, 1 Madison Ave., New York, N. Y., has published in brief a report by the Research Committee of the New England Council, entitled "Better Business Through Research in New England Industry." The report covers the fact-finding or research practices of certain New England companies and indicates what research has done for sales, buying, and employment stabilization. A list of the co-operating organizations is included. The publication contains 32 pages.

NEWS OF THE WEEK

Details of the Dodge Gift Announced

THE Taylor Society has announced the details of the presentation of the James Mapes Dodge Fellowship, established recently by Mrs. James Mapes Dodge in memory of her husband, who was the first president of the Taylor Society. The benefits of the fellowship are available to graduates of engineering schools, schools of business administration, commerce and finance, and all schools and departments of university and college rank in which management forms an important subject of the regular instruction.

A Fellow who has been appointed for the two year tenure will apportion that period as follows: Four months of autonomous study of scientific management in the library of the Taylor Society, Engineering Societies Library and other libraries in New York, under the direction of H. S. Person, managing director of the Taylor Society (formerly director and professor of organization and management, the Amos Tuck School of Administration and Finance, Dartmouth College). The study will also involve special conferences arranged by the Taylor Society with engineers engaged in management development service; one year of continuous work in a scientific management plant; five months of travel and inspection of other plants; three months of additional autonomous study and writing of a thesis in the library of the Taylor Society, under the direction of H. S. Person, managing director.

Documents presenting in detail the conditions of this Fellowship, and in particular the conditions of eligibility and of application, will be available in February.

The trustees of the fund have been selected as follows: George D. Babcock, Dodge Brothers, Inc., vice-president of Taylor Society; William Crozier, Major General, U.S.A., retired; Henry S. Dennison, president, Dennison Manufacturing Co.; John R. Freeman, consulting engineer, Providence; Morris E. Leeds, president, the Leeds & Northrup Co.

Coast Engineers Open Clubrooms

The new home of the Engineers' Club of San Francisco on the fourteenth and fifteenth floors of the recently completed Insurance Center Bldg., at Pine and Sansome Sts., was dedicated at a recent dinner meeting. Although members only were present, a capacity crowd filled the clubrooms. Following the dinner, the president of the club announced that the board of directors had, by unanimous vote, elected Dr. Harris J. Ryan, of Stanford University, to honorary membership.

Short addresses were made by two prominent members of the club. "The Engineer from the Viewpoint of Finance," was presented by Frank L. Lipman, president of the Wells Fargo Bank and Union Trust Co.; and "The Engineer's Place in Industry," by Charles W. Merrill, metallurgical engineer, who was the first president of the club.

Fairchild Consolidates Air Interests

Consolidation of seven aircraft companies into the Fairchild Aviation Corporation of Delaware with a paid-in capital of $1,553,550 was announced last week. This with the recently organized Faircam Realty Corporation, with a paid-in capital of $400,000, will bring the active Fairchild interests to almost $2,000,000 of capital to be devoted to aviation and its promotion.

The Fairchild Aviation Corporation is the holding company for the Fairchild Aerial Camera Corporation, Fairchild Aerial Surveys, Inc.; Fairchild Flying Corporation, Fairchild Aviation, Ltd.; Fairchild Caminez Engine Corporation, Fairchild Airplane Manufacturing Corporation and Compania Mexicana de Aviacion.

S. M. Fairchild Is President

The directors of the new company include Sherman M. Fairchild, president; Robert Law, Jr., chairman; Governor John H. Trumbull, George H. Townsend, G. B. Grosvenor, George R. Hahn, William Dewey Loucks, Talbot O. Freeman, Ernest Robinson, John Paull and Harold Kondolf.

The realty corporation will own the land and buildings, consisting in land of about eighty-five acres at Farmingdale, L. I. Part of this will be used for factory units, contracts for which have been let. The remainder of the land will be turned into a modern airport, with hangars and aviation garage with necessary equipment.

The engine company will continue to manufacture the present 135-hp. cam type engine, Mr. Fairchild said, and designs have been completed for an 80-hp. engine of the same type. It also has been shown in experimentation, he added, that the engines may be tandemed and thus a sixteen cylinder, 800-hp. air-cooled engine for large transport planes is in contemplation.

Norton Co. Acquires Bethel-Player

THE Norton Co. has purchased the entire capital stock of Bethel-Player & Co., Inc., of Westboro, Mass., manufacturers of lapping machinery. It is the intention of the Norton Co. to make these products in the Worcester plant and market them through the Norton sales organization.

The Bethel-Player products consist of crankshaft lapping machines, cylindrical and flat lapping machines, hole and cylinder lapping machines, and toolroom bench laps.

These lapping machines find a market in manufacturing plants producing automobiles, aircraft engines, electrical apparatus, calculators, fine tools and gages, pneumatic tools, high pressure pumps, roller bearings and optical goods.

Bethel-Player & Co. was organized in Westboro in 1922 by Joseph N. Bethel and Sydney Player. In June, 1927, the company was re-organized. The number of products has increased from one type of lapping machine to thirteen.

Definite plans have not yet been made for moving the equipment of the Westboro plant to Worcester. When the business is made part of the Norton Greendale plant, a number of the men who have been connected with the Westboro organization in various capacities, including both Joseph N. Bethel and Sidney Player will continue their association as part of the Norton organization in the production and sale of the lapping machinery.

Metric Bill Again Before Congress

Representative Britten, as is his custom with the opening of each Congress, has introduced a metric bill. It is known as House Joint Resolution 10, which provides "That the Department of Commerce be authorized and directed to conduct, within one year, a thorough investigation and study to determine the advisability of adopting metric weights and measures for general use in the United States. This department, after making such investigation and study, is hereby authorized to initiate and carry out, to such extent as may be deemed advisable, plans to encourage the general and common use in the United States of such system of weights and measures."

The bill has been referred to the House Committee on Coinage Weights and Measures and hearings will be announced later.

Metal Working Industry in France Slows Down Before Elections

Machinery and tool production low

By Our Paris Correspondent

AFFAIRS in basic metallurgical lines have seldom been so calm. The pick-up of the autumn was short of what was hoped for and there is a slowing down of new business already. Current business from the metal transforming trades has not been such as to tax raw material and semi-raw material production facilities to anything like capacity. The best and the most which has been accomplished to date has been to keep partial working forces working full time or skeleton crews on part time with general overhead and fixed charges being carried by a limited output and finally passed on to the consumer.

The political situation has a direct bearing on future industrial and trade prospects. A general election is booked for a few months hence. Monsieur Poincaré himself seems to have doubts as to the stability of his reign but urges the country to take measures to continue his policies which have partially revalorized the franc, balanced the budget of the last two years, and reduced the index costs of raw material from abroad in most lines of merchandise imported for use in home industries.

There is a stock exchange rumor of a new national loan for various government needs but, in general, it is considered that the power of absorption by Paris and the provinces is not unlimited as was shown by the side-stepping of the State railway loan last month. It is possible, however, that additional funds will be appealed for on behalf of the liberated regions of the old war zone which in spite of a remarkable revival is by means in full economic and industrial swing as yet.

As to the American tariff settlement, even as arranged for the time being, rock bottom is reached only on those items which are not included in the Franco-German tariff accord. Where an item appears on the latter the tariff on such an article of American manufacture stays at that point regardless of the more favorable rate it may have had before Sept. 6.

German competition, stronger than ever, will have to be met. This will affect many lines of metal manufactures and perhaps tool steel and machinery and motor car accessories. What has been largely overlooked, as the *Berlin Borsen Courrier* remarks, is that the United States, enjoying the "most favored nation" treatment in Germany, benefits in that country from all the minimum tariff concessions granted to France.

Foreign exchanges of merchandise have recently undergone a considerable evolution in France, as well in respect to tonnage as to the value in current francs. In the first nine months of 1927, as compared with a like period in 1926, imports of copper, lead, tin and zinc fell off 85,000 metric tons. Machinery and other manufactures of metal followed, diminishing to the extent of 40,632 tons. Contrariwise, exports of machinery, etc., increased 227,548 tons, while iron and steel swelled in bulk over a million tons. The obvious comment is that France is making progress.

Machinery and tool fabrication has reduced production figures notably. Sales are difficult. Agricultural machinery has improved its position above all in so far as prime movers and producers of power are concerned. Competition in gasoline and heavy oil motors is active, based on price and power. Electrical machinery is showing unexpected demand.

With nothing more than rumor to go on there is a disposition among European automobile manufacturers in general to reduce the number of models and perhaps the making of a consortium agreement on international European lines in order to meet American competition. In so far as the French industry is concerned there are two camps in evidence, one urging adoption of American methods, the other a return to French ideals with possibly a mild adaptation of American methods. A greater market for automobiles is seen for France than anything which has gone before, but this means increased and improved production methods. All authorities agree on this. France consumes 60 per cent of its present production and exports 40 per cent, according to late figures. While the argument is lined up that the American interior consumption is 90 per cent of output, thus arguing that American methods can not be applied as a whole here. The Citroen plant, which has made the greatest and most efficient progress in production methods, is claimed by Monsieur André Citroen himself to have practically equalled American quantity and cost production when figures are considered proportionately. He claims that his steel stampings cost no more, and that chassis assemblage by the chain system of his single model output takes but 45 min., with a final assertion that a model plant in France with modern equipment could be counted upon to produce results equal to those arrived at in America if only it was possible to distribute a quantity product of the same proportions.

Monsieur André Michelin, of the tire company which bears the family name, states that France already has an automobile production of a value 7 billion francs per year which is achieved with a capital investment of 4 billion francs and 400,000 workers. This, he claims, is a better turnover than is possible in the United States by 25 per cent. The 7 billion francs production of the French automobile industry is just fourteen times as great as that of the combined French electrical industries, according to the same authority. He foresees an ultimate French production of half a million cars per year, which implies a vast need of new machinery installation of ultra-equipment as man power is about at its limit of numbers and capacity in France today.

The nut and bolt trade is in a dull period owing to a lack of agreement among makers and distributors as to price and discounts. An expected agreement between screw makers has not yet materialized. Competition in all chain lines is responsible for the dull market, buyers holding off from stocking.

Reproduction of the bronze medal issued by the Baltimore & Ohio Railroad to commemorate the completion of one hundred years of American railroad achievement. One side of the medal shows the "Tom Thumb," designed by Alderman Peter Cooper, of New York, and is said to be the first steam locomotive built in the United States. The other side of the medal shows one of the most modern trains of the B. & O., drawn by one of the largest passenger locomotives, and guided by the Spirit of Transportation. The medal was designed and executed by Hans Schuler

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THE END of 1927 is now near enough to make an appraisal of it as a business year. In most of the financial indices new high records will be set, while with few exceptions the industrial record will be one of moderate contraction as compared with 1926. If a balance sheet of the year could be drawn up to picture the state of the nation's business, the industrial contraction should undoubtedly be listed in the asset column, because it is assurance that stocks are not excessive and that production must probably expand to meet 1928 needs. On the other hand, it is not unreasonable to consider the flow of money into securities as a liability, because its eventual return to the reservoir will probably be accompanied by declines in the price of stocks and bonds which may be depressing.

A balance sheet drawn up on the theory that most of the "bad news" belongs with the loans on the asset side, and that much of the "good news" should be listed with the capital and deposits among the liabilities, might read somewhat as follows:

Assets: Building contracts awarded in 1927 will show a trifling decline, perhaps 1 per cent from the 1926 total.

Iron and steel production will be about 8 per cent less.

Automobile output will be more than 20 per cent smaller.

Railway car loadings will be about 2½ per cent less.

Coal and lumber production will each be about 9 per cent smaller.

The foreign trade total will be slightly less, due to a decline of 5 per cent in imports.

Business failures will show an increase of 3 to 5 per cent.

Wholesale and retail trade will not show the normal annual increase.

Liabilities: The average price of stocks at the end of the year will be at least 25 per cent higher than at the beginning.

Bond prices will be about 4 per cent higher.

New security offerings for the year will be half as large again as in 1926.

Bank loans and investments will show a gain of about 8 per cent during the year, and virtually the entire increase will be in purchases of and loans against securities.

Loans to members of the New York Stock Exchange will be about 7 per cent greater.

The gold output of the Rand will make a new high record for all time, and index numbers of wholesale prices, despite a drop earlier in the year, will stand 3 to 4 per cent higher at its close.

Cotton and silk consumption will each make new high records.

This classification is of course highly impressionistic and when the balance sheet drawn according to this theory is completed there are some items that will not fit in. The cash value of the major crops this year is estimated at 12½ per cent larger than in 1926, and that is both good news and an asset because it represents a more equitable purchasing power for the farmer. The same is true of the steady gains of the electrical industry, which will probably continue for many years and is one of the mainsprings of business activity.

In the record of the past week something of the realigning process is faintly discernible. The high level of cotton mill activity, which has been of record-breaking proportions for a year, is threatened as the movement to curtail gains headway; in the South many of the mills have announced that they will close from each Friday noon until Monday, and all or part of the holidays.

In the automobile industry optimism is rampant, and though the advent of the Ford has not yet revived sales for other manufacturers the trade reviews and many of the business prophets think the show season will start the industry off to its biggest year. In iron and steel orders for first quarter delivery are increasing, steel production is gaining slightly, and prices are firmer.

Commodity prices on the whole are steady to firm. The recent leaders in the upward move, copper and rubber, have paused, but the grains, coffee, cotton, and silk now seem more difficult to depress than they have lately been; hides and leather are holding their ground, and there is even talk of an advance in oil despite the huge stocks that are accumulated and production that is still in excess of demand. The agreement of the oil industry to jointly control the output of the big pools keeps prices steady. To this same industrial co-operation the advance in copper is ascribed, and the sugar refiners, who have been operating on non-profit margins and under the keenest of price-cutting competition, are planning an American Sugar Institute which by collecting statistics and establishing a code of practices would aid in stabilizing their market.

How long the money markets can be kept in balance, and the disruption of the stock market from its own internal strains can be prevented, are questions that none can answer, and while it is of importance for the New Year, consideration of it need not prevent business from enjoying a Merry Christmas.

WHAT'S DOING IN INDUSTRY

DECEMBER continues to furnish a surprising volume of business to dealers and agents in the machinery and machine tool trade. From more than one large industrial center come reports of the closing of orders that had previously been held up. A desire to complete pending contracts before a new year begins, together with price advances in many leading lines, is believed to be the stimulant of present buying activity.

THE IMPROVEMENT in Cincinnati is being sustained and general business activity is good. Chicago is marking time, but Cleveland reports a steady volume of small orders with inquiries for later delivery in good number. Little improvement is noted in Milwaukee, but prospects are bright. The awakening in Detroit is not complete, but dealers are optimistic over the prospects when automobile manufacturers get started on their new programs.

SALES of special machine equipment are fair in Western New England, but in the Eastern section a seasonal dullness prevails. The last quarter of the year in Buffalo turned out to be the best of the whole year. With buying for the month about over, New York dealers report a better volume of sales than was expected. Spasmodic buying of single tools is sustaining a fair market in Philadelphia.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CLEVELAND

A steady volume of business has come into the local machinery and machine tool industry during the first two weeks of December. A cessation of buying, however, is expected during the holiday season. Inquiries are reported unusually brisk for this time of the year. As a barometer for better business it is noted that the inquiries are more general in scope.

Railroads are the leading purchasers at the present time. Automobile manufacturers are also doing some buying. Export business has shown considerable improvement recently. Orders for bending and forging machines have been received from Australia and New Zealand. Manufacturers of automatic machinery report better business activity and an increase in inquiries.

PHILADELPHIA

Machinery and machine tool producers in Philadelphia found little change in the business and industrial situation last week. Some spasmodic buying was reported but nothing of a substantial nature was forthcoming.

The impression prevails among dealers and manufacturers that with the coming of 1928 the many industries which have failed to make purchases will enter the market when new budgets become available. The industry looks for buying from general industrial establishments as well as from automotive and railroad plants, this view being based upon the theory that basic economic conditions are sound. One plant dealing with material for automobiles is preparing to operate at full capacity during the early months of the new year, and others look for an increase in operations.

EASTERN NEW ENGLAND

In a canvass of leading houses in the section covering Eastern New England, it is found that business in machine tools shows little or no gain over business of last week. Some houses report inquiries as frequent, but closings are few; other concerns claim business as very dull, laying this condition to the season of the year.

The machine shop supply industry continues to show a very satisfactory condition considering the season. Business in shop accessories continues brisk, while other lines of supplies are holding their own with the average for the month. One house reports transactions as considerably exceeding the number for this time last year, and is optimistic for business during the coming year.

MILWAUKEE

On the whole, the call for metal working equipment shows little if any improvement, unless a slight increase in inquiry may be accepted as an indication of greater future activity. Orders booked so far this month, on the average, equal those of the same period a year ago.

The automobile industry so far has given no marked sign of new interest, such as some expected might follow soon after the Ford announcement. On the other hand, confidence is expressed that by the middle of January the situation should shake itself down to a point where fresh needs of equipment may be definitely gaged. Meanwhile equipment builders are working on some orders of moderate size placed within recent weeks which will require until February or March to complete and deliver.

General industries are the principal buyers of equipment, and nearly all orders suggest replacements. There appears to be no special pressure upon the existing facilities of any class of metal working shop.

WESTERN NEW ENGLAND

Conditions in the Western New England section are typical of the inventory period. Prospective business, however, is plentiful. Closings, as a whole, are in better volume than is to be anticipated at this time of the year. Shop supply dealers find business reasonably good. Machine tool and machinery dealers report considerable sales resistance.

Manufacturers of production machinery, such as presses, metal forming, and automatic screw machines, are closing a good year. Orders have shown but little decline throughout December and the outlook is good. A New Britain iron works is to spend in excess of $200,000 for conveying, stoking and pulverizing machinery, and a continuous annealing and cooling system.

CHICAGO

Business in the machine tool industry is just about marking time, being neither better nor worse than for some weeks. Occasional sales are reported of some of the larger types of tools to industrialists, but the market generally is without feature. Inquiries have fallen off somewhat, but still are received in sufficient number to justify a feeling of tempered optimism with respect to early buying in 1928. The announcement that an Indianapolis concern has acquired about 800 used tools from an automotive manufacturing plant of that city, and will dispose of them to dealers or users, does not seem to have disturbed the local trade to any appreciable extent.

The predicted advance in prices on millers, grinders and shapers, averaging 10 per cent, has materialized. The advance, however, does not apply to all makes, a representative of one of the leading plants manufacturing milling machines stating that his company has no expectation of advancing prices, at least for the present.

CINCINNATI

Taking the machine tool industry of the Cincinnati district as a whole, there seems to have been some improvement in business in the past week. It is true that manufacturers have ceased to hope for a spurt of business this month that will bring this year's sales up to the level of last year, but selling agents express the opinion that a better market is developing in local territory, with indications that a great many orders that are now being held back will be released soon after the first of the year.

Some fair orders are reported as having been booked in the past week, but the sustaining market feature was the sale of single tools to general machinists and miscellaneous users. A local sale consisted of five lathes for the shops of the street railway company. Scattering orders from the automotive field called for single tools and replacements.

The number and the tone of the inquiries that were received in the past week, it is stated, are a good basis for more than a little encouragement.

DETROIT

While many fair orders for machinery and machine tools have been received here during the past two weeks, the condition of the market cannot properly be called brisk. For some weeks past there has been a slight increase in business that seems to have been due largely to the fact that machinery prices in many lines are increasing and automobile manufacturers here were endeavoring to take advantage of old prices.

Ford has done some buying within the past few days and is expected to do a great deal more after New Year's. Chevrolet is buying equipment for the production of its new model, soon to be brought out. Dodge is making an expansion and Paige is fairly active.

There are many inquiries being received for every kind of equipment but it is generally believed that the next two weeks will be marked by a noticeable holiday let-down. Many of the factories here are getting ready for inventories and therefore will not be doing any buying.

BUFFALO

Surprising as it may seem in the light of experience of previous years, the machine tool trade in Buffalo is holding up well here. The first half of December seemed to indicate that the month would show a larger volume of business than that of November. Several dealers reported that the last three months of the year will undoubtedly show the biggest business of any quarter this year.

In the electrical field activity is somewhat less marked. A fair volume of small orders is holding up the average. The demand for contractors' equipment is better in this district than at any time in several months. The open weather has encouraged construction but the sales of snow removal equipment to date have been small.

NEW YORK

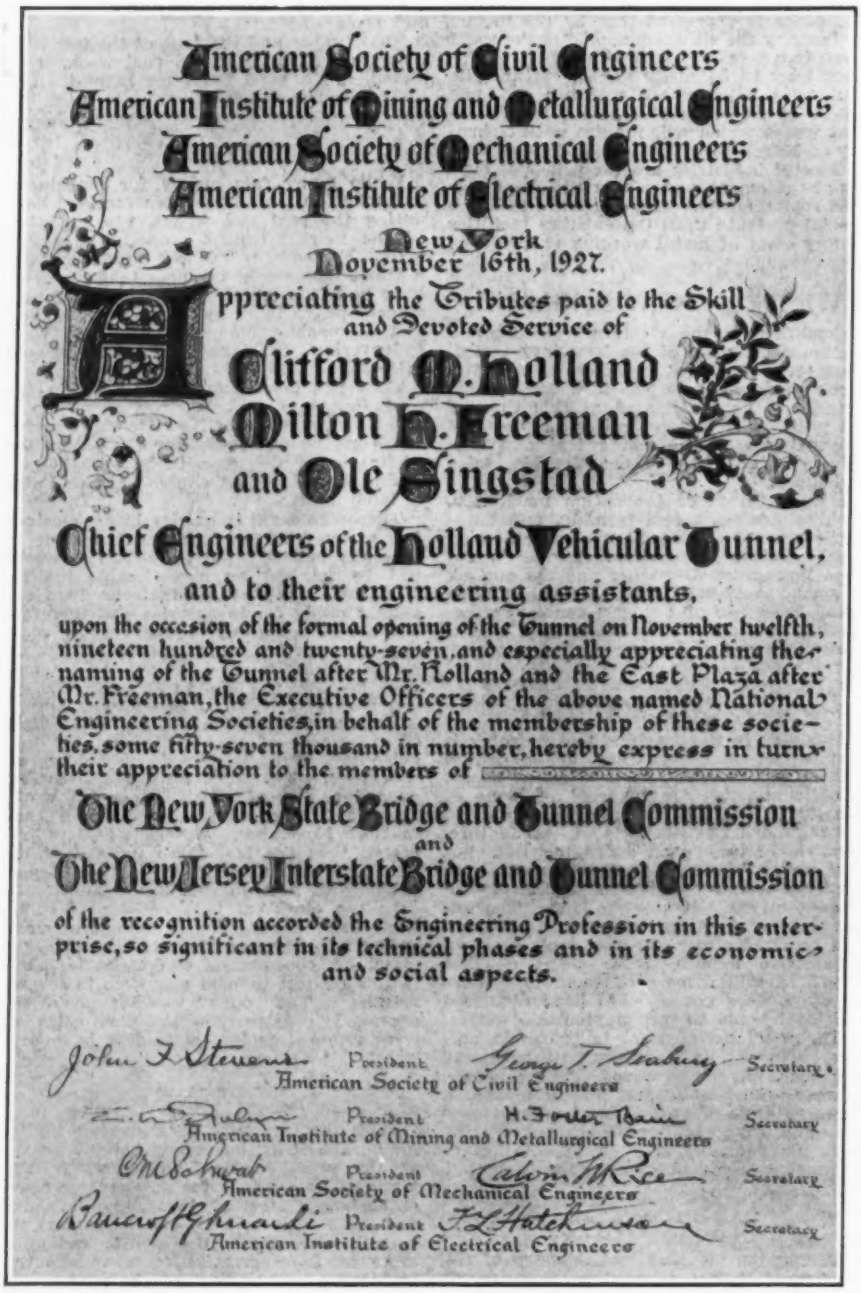
With the last week of December broken up by the most important holiday season of the year, dealers and agents in this territory do not look for any great amount of business. Most of them are quite satisfied with the volume closed during the first three weeks of the month, and prospects on hand promise some very active business after the first of the year.

Current business comes mostly from small users. Large industrials are about through for the year and will do no buying until after new appropriations are allotted. Inquiries at this time of the year are hard to analyze. Large lists are heard of here and there, but it is generally believed that they are for budget or inventory purposes and not seriously intended as part of actual buying programs.

Lathes, shapers, radial drills, braking machines and die sinkers are represented in last week's orders. A boring mill, a large driving wheel lathe and a vertical forcing press were also purchased.

Editors Witness Test of Arc-Welded Roof Truss

At the Trenton Works of the American Bridge Co., on Dec. 16, a group of engineers, architects and editors were guests of the Bridge Co. and the General Electric Co. to witness overload tests of an arc-welded roof truss. After a trip through the fabricating shops where they were able to contrast the methods used in making riveted and welded trusses and girders, the visitors watched the application of the final units in the 50 per cent overload that was applied to the 58-ft. welded truss. Under this load a deflection of slightly less than ¾ in. was measured. Since the truss was constructed with a 2-in. camber the bottom chord still had appreciable camber under the overload. Savings of 10 to 20 per cent in cost over riveted construction are being realized in the construction of the welded trusses, according to official figures.



American Society of Civil Engineers
American Institute of Mining and Metallurgical Engineers
American Society of Mechanical Engineers
American Institute of Electrical Engineers

New York
November 16th, 1927.

Appreciating the Tributes paid to the Skill and Devoted Service of

Clifford M. Holland
Milton H. Freeman
and Ole Singstad

Chief Engineers of the Holland Vehicular Tunnel,

and to their engineering assistants,

upon the occasion of the formal opening of the Tunnel on November twelfth, nineteen hundred and twenty-seven, and especially appreciating the naming of the Tunnel after Mr. Holland and the East Plaza after Mr. Freeman, the Executive Officers of the above named National Engineering Societies, in behalf of the membership of these societies, some fifty-seven thousand in number, hereby express in turn their appreciation to the members of

The New York State Bridge and Tunnel Commission
and
The New Jersey Interstate Bridge and Tunnel Commission

of the recognition accorded the Engineering Profession in this enterprise, so significant in its technical phases and in its economic and social aspects.

John F. Stevens, President — George T. Seabury, Secretary
American Society of Civil Engineers

President — H. Foster Bain, Secretary
American Institute of Mining and Metallurgical Engineers

President — Calvin W. Rice, Secretary
American Society of Mechanical Engineers

President — F. L. Hutchinson, Secretary
American Institute of Electrical Engineers

In appreciation of the recognition given to the engineering profession by the members of the New York State Bridge and Tunnel Commission, and the New Jersey Interstate Bridge and Tunnel Commission, in connection with the construction of the Holland vehicular tunnel, four of the national engineering societies presented to the commissions an engrossed set of resolutions. The presentation address was made on Dec. 13 by Col. Willard T. Chevalier, general manager of Engineering News-Record, *and a member of the board of directors of the American Society of Civil Engineers.*

The four organizations are the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers and American Institute of Electrical Engineers

New England Machine Tool Builders Meet

In spite of bad weather a goodly number of New England machine tool builders met at the Hotel Kimball, Springfield, Mass., for a regional meeting at which P. E. Bliss, president of the National Machine Tool Builders' Association, presided. Firms from Boston, Greenfield, Hartford, New Britain, Providence, both Springfields, Worcester and surrounding cities were represented. General manager DuBrul had several interesting charts showing business conditions, as well as the unsatisfactory returns that have been the lot of the average builder during the past few years. This was contrasted with the returns stockholders considered to be fair and equitable as given in recent statements by President Sloan of the General Motors Corporation, and others

Depreciation, obsolescense, cost accounting and standardization were discussed at length and from various angles. Figures from various companies showed a complete lack of appreciation of wear life, obsolescence, replacement, and cost accounting methods which led to wide variations in price for similar machines and also showed why some shops struggle along with inadequate equipment.

The substitution of frequent group meetings instead of regional meetings was discussed and favored. There was also an unfavorable expression toward the consideration of both a cost accountant and a standardization engineer to visit the plants of the various members both to discuss the advantages of modern cost accounting methods and of standards, and to work with their own men along both lines. The standardization plan does not involve a uniformity of all products as some seem to imagine but rather to avoid unnecessary expense in new designs, to simplify existing practice and to secure the adoption of such universal standards as are demanded by machine users.

Bureau Makes Tests on Bearings Load

Sad experience has taught the average motorist to heed the manufacturer's warning not to drive a new car with a heavy foot on the throttle for at least the first 500 miles. The reason for such a warning is that the bearings cannot be run safely and efficiently at full load until they are well run in. This same precaution is necessary in the initial operation of other machines.

In order to measure the effect on journal bearing performance of progressive amounts of running in, a series of experiments has recently been made at the Bureau of Standards, using a specially designed journal bearing friction machine. In this machine it is possible to measure the frictional loss when operating under different conditions of load on the bearings, speed of the journal, and viscosity of the lubricant.

Personals

ARTHUR JACKSON, president of the Arthur Jackson Machine Tool Co., of Montreal, Canada, sailed for Bermuda on Dec. 21.

J. T. CONNERS has been appointed district manager in Cleveland for the Harnischfeger Corporation. He will be located at 340 Rockefeller Bldg.

WILLIAM P. KIRK has been appointed general sales manager for the Niles-Bement-Pond Co., the Pratt & Whitney Manufacturing Co., and the Niles Tool Works.

J. W. WHITE has been elected managing director of the Westinghouse Electric Co. of Japan. Mr. White was at one time manager of the power section in the company's Detroit office.

O. B. ILES, president of the International Machine Tool Co., of Indianapolis, was elected a director of the Indianapolis Chamber of Commerce. Mr. Iles is a past president of the organization.

W. R. BEAN has been elected president of the Grindle Fuel Equipment Co., of Harvey, Ill., succeeding R. H. Bourne, who resigned. Mr. Bean has been vice-president and consulting engineer for the company.

I. F. BAKER has been appointed manager of the Far Eastern department of the Westinghouse International Co. He was previously manager of the company's business in Japan.

R. M. WELCH has joined the staff of G. W. Brogan, Inc., of Towson, Md., advertising agent. Mr. Welch is known as an expert in automotive service engineering, having been recently in charge of that work for the Consolidated Gas, Electric Light and Power Co., in Baltimore.

ZENO C. WILKINSON, formerly sales manager of the Youngstown Pressed Steel Co., has become vice-president and a director of the Peter Smith Heater and Manufacturing Co., of Detroit. In this new position he will be in charge manufacture and sales.

A. R. HAUSCHEL, European manager for the J. I. Case Threshing Machine Co., Racine, Wis., with headquarters in Paris, has been promoted to the position of director of export sales, filling the vacancy caused by the recent death of W. W. Ramsey.

OSWALD DALE has been elected vice-president of the Wheeler Insulated Wire Co., of Bridgeport, Conn. Mr. Dale has been head of the radio department of the Acme Wire Co., New Haven, and will continue to act as consulting engineer for that company.

HARRY O. KING, vice-president and general manager of the Bassick Co., Bridgeport, Conn., has been elected president of the Schick Repeating Razor Co.; and Walter B. Lasher, president of the American Chain Co., of Bridgeport, was named chairman of the board of directors.

VAN CORTRIGHT MEKEEL, has become special representative of the Nugent Steel Castings Co., of Chicago. Mr. Mekeel was formerly special research investigator and mechanical engineer for the Taylor-Wharton Iron and Steel Co., of High Bridge, N. J.

J. A. HANSEN, chief tool designer for S. F. Bowser & Co., tank and pump manufacturers, at Fort Wayne, Ind., is leaving shortly to become connected with the Firestone Tire and Rubber Co. at Akron, Ohio. Mr. Hansen is secretary of the Fort Wayne section of the American Society for Steel Treating.

CHARLES L. NEWCOMB has resigned as works manager of the Deane Works of the Worthington Pump and Machinery Corporation, at Holyoke, Mass. Mr. Newcomb retires after 46 years of active service in the mechanical industries. He has been succeeded at the Deane Works by Hugh Benet, who has been associated with the Baltimore office of the company.

LAWRENCE T. KRATZ has been appointed purchasing agent for the Celeron Co., a division of the Diamond State Fibre Co. Wallace McCarter has been appointed buyer for the Diamond organization. W. A. Knerr, formerly purchasing agent for both companies, is now secretary of the Norristown Section of the Pennsylvania Manufacturers' Association.

NORMAN F. KIMBALL has been appointed manager of advertising for the American-LaFrance and Foamite Corporation, a combination of the American-LaFrance Fire Engine Co., and Foamite-Childs Corporation. Mr. Kimball's experience in the fire protection engineering fields covers about fifteen years, being successively assistant hydraulic engineer at the Underwriters' Laboratories in Chicago; chief engineer of the former O. J. Childs Co., and assistant general sales manager of the Foamite-Childs Corporation.

Business Items

The Lacey Manufacturing Co., of Union Ave., Bridgeport, Conn., has been appointed sales representative for the U. S. Tool Co., of Ampere, N. J. A complete stock of die sets will be carried in the Lacey plant.

The Peninsular Stove Works began operations in its new plant in Brightmoor, near Detroit, on Dec. 15. The plant is modern in every particular, being equipped with the latest machine tools and labor saving machinery.

The plant, equipment and stock in trade of the Morgan Manufacturing Co. at Keene, N. H., manufacturer of screw machine products, has been sold to the Keene Development Co. The sale was ordered by the court to close receivership.

The Bridgeport Brass Co., of Bridgeport Conn., has established a branch office in the Park Square Bldg., Boston, Mass. William J. Hawkins, who has been the company's sales representative in Boston for many years, will be in charge of this office.

More than 70 field representatives of the Sullivan Machinery Co. were at the factory in Michigan City, Ind., recently to attend the third annual sales conference. A. Y. Hoy, manager of the London office, was the only representative from abroad.

The Chicago Machinery and Steel Co. has been organized and has established headquarters at 263 N. California Ave., in Chicago. The company will buy and sell new and used machine tools, hoists and structural equipment. William P. Devery is the owner and manager.

The Torrington Co., of Torrington, Conn., has purchased the Tiley-Pratt Co., of Essex, Conn., which manufacturers similar products. Production will continue at the Essex plant under the management of Morton C. Tiley and Paul N. Sampson, both of whom with Charles B. Tiley were formerly officials of the Tiley-Pratt Co.

The Southwark Foundry and Machine Co., of Philadelphia, acting jointly with the Emery-Tatnall Co., announces the establishment of a testing equipment division, offering a diversified line of physical testing machines and instruments. Among the machines available are: Emery testing machines, Huggenberger tensometer, electric telemeter, and the Beggs deformeter.

In our report of the Power Show in last week's issue, we neglected to mention that the Landis Machine Co., of Waynesboro, Pa., was another machine tool builder exhibiting equipment at the show. This company displayed a Landis pipe-threading and cutting-off machine, Land-Matic heads, Lanco heads and Victor collapsible taps.

Obituaries

WATSON J. HASSELMAN, 74 years old, one of the founders of the Sinker-Davis Machine Co., of Indianapolis, died recently at Battle Creek, Mich.

WILLIAM P. PALMER, president of the American Steel and Wire Co. since 1899, died at his home in Cleveland, Ohio, on Dec. 17. Mr. Palmer was associated with the steel industry for a life time, being at one time assistant to the president of the Carnegie Steel Co., and vice-president of the Illinois Steel Co.

A. H. NILSON, president of the A. H. Nilson Machine Co., of Bridgeport, Conn., died on Dec. 12 at his home in that city. Mr. Nilson was a native of Sweden; he came to this country in 1880. He was head of the machine department of Cornwall & Patterson, Bridgeport, for many years.

MELVILLE W. MIX, twice mayor of Mishawaka, Ind., and for many years president of the Dodge Manufacturing Co., of Mishawaka, and known throughout the Middle-West as a leading manufacturer, died on Dec. 11. We was a member of the American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Testing Materials, Indiana Engineering Association, and the American Supply and Machinery Manufacturers' Association.

Forthcoming Meetings

American Association for the Advancement of Science. Second Nashville meeting, Nashville, Tenn., Dec. 26-31, general headquarters Andrew Jackson Hotel. General chairman, W. S. Leathers, M.D., professor of preventative medicine and public health, Vanderbilt Medical School, Nashville, Tennessee.

National Safety Council. Rhode Island Industrial Safety Conference, Biltmore Hotel, Providence, R. I., Jan. 17. A. A. Mowbray, secretary, 108 East Ohio St., Chicago.

Society of Automotive Engineers. Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 24 to 27. C. E. Heywood, in charge of meetings, 29 West 39th St., New York City.

Foundry Equipment Manufacturers' Association. Annual meeting, Feb. 7, 1928, Cleveland Hotel, Cleveland, Ohio. H. Cole Estep, secretary, 1213 Third St., Cleveland.

American Society for Steel Treating. Semi-annual meeting, Montreal, Canada, Feb. 16 and 17, 1928. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

American Gear Manufacturers' Association. Twelfth annual meeting, Rochester, N. Y., April. Details later. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

American Welding Society. Annual meeting, week of April 23, New York City. M. M. Kelly, secretary, 33 West 39th Street, New York City.

American Railway Association. Schedule of sectional meetings: Division IV, Engineering, March 6 to 8, Chicago Division V, Mechanical, June 13 to 20, Atlantic City, N. J.; Division VI, Purchases and Stores, June 13 to 15, Atlantic City, N. J.

National Metal Trades Association. Thirtieth annual meeting, Hotel Astor, New York, April 25 and 26. J. E. Nyham, secretary, Peoples Gas Bldg., Chicago, Ill.

National Foreign Trade Council. Fifteenth anniversary convention, Houston, Texas, April 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Aug. 29 to 31. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8 W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

FIRMER prices for most of the finished steel items, wire products, and sheets, also substantial advances in quotations on wire nails, iron and steel scrap, copper scrap, and furnace coke, are features of the current market in shop materials and supplies. Pig-iron prices, however, continue weak; in addition to that, the recent advances in non-ferrous metals do not appear to hold. There is increasingly active demand for railway material and automobile sheets. The strength of present steel quotations dispels all expectation of lower prices in the next quarter, yet no unusual acceleration in buying is indicated.

(All prices as of Dec. 16)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities rom warehouse: also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.15	3.50	3.25	3.89
No. 12	2.15@2.20	3.55	3.30	3.94
No 14	2.20@2.25	3.60	3.35	3.99
No 16	2.30@2.35	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.55@2.70	3.75	3.55	4.00
No. 22	2.70@2.85	3.90	3.70	4.15
No. 24	2.75@2.90	3.95	3.75	4.20
No. 26	2.85@3.00	4.05	3.85	4.30
No. 28	3.00@3.25	4.20	4.00	4.45
Galvanized				
No. 10	2.90@2.95	4.10	3.80	4.25
Nos. 12 to 14	3.00@3.05	4.20	3.90	4.35
No. 16	3.10@3.15	4.30	4.00	4.45
No. 18	3.25@3.30	4.45	4.15	4.60
No. 20	3.40@3.45	4.60	4.35	4.75
No. 22	3.45@3.50	4.65	4.40	4.80
No. 24	3.60@3.65	4.80	4.50	4.95
No. 26	3.85@3.90	5.05	4.75	5.20
No. 28	4.10@4.15	5.30	5.00	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to.30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	5.70	6.10
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex.†	4.00	3.65	3.60
Cold drawn, flats and squares	4.50	4.15	4.10
Structural shapes	3.34	3.00	3.10
Soft steel bars	3.24	3.00	3.00
Soft steel bar shapes	3.24	3.00	3.00
Soft steel bands	3.99	3.65	3.65
Tank plates	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †also shafting and screw stock.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			15.37½
Tin, pigs, 5-ton lots, New York			60.50
Lead, pigs, up to carlots, E. St. Louis 6.35		New York	7.12½
Zinc, slabs, up to carlots, E. St. Louis 5.70		New York	6.62½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	13.50	14.00	14.25
Copper sheets, base	22.75	22.75	22.50
Copper wire, base	19.25	19.25	15.50*
Copper bars, base	22.25	22.25	22.00
Copper tubing, base	24.50	24.75	24.25
Brass sheets, high, base	18.75	18.75	18.50
Brass tubing, high, base	23.62½	23.62½	23.37½
Brass rods, high, base	16.50	16.50	16.25
Brass wire, high, base	19.25	19.50	19.00

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	24.37½@25	26@27	26.02
Zinc sheets (casks)	11.00	12.65	10.11
Solder (½ and ½), (case lots)	36.75	37.50	34@38

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	76.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	12.50

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	37.00
Shot	36.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	12.37½@12.62½	11.00	11.00@11.50
Copper, heavy, and wire	11 87½@12 37½	10.75	10 25@10 75
Copper, light, and bottoms	10 50 @10 75	9.50	9.25@ 9 75
Heavy lead	5 25 @ 5.50	5.25	4.75@ 5 25
Tea lead	4 25 @ 4.50	3.75	4.00@ 4.50
Brass, heavy, yellow	7 25 @ 7.50	7.25	7.00@ 7.50
Brass, heavy, red	9.00 @ 9.50	9.75	9.00@ 9.50
Brass, light	5 50 @ 6.00	5.75	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc	3.37½@ 3.62½	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@ .17
Wiping cloths, washed white, per lb	15½@17½	36.00 per M	.15
Sal soda, per lb	.03½	.02	.02½
Roll sulphur, per lb	02⁷	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	79½	.89	80
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.50	.50
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.27	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%*
Second grade	50–10%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60-10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.16½	.16	.1637½
Solder (½ and ½)	per lb.	.36¾	.35¾	43
Cotton waste, white	per lb.	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.27	.27	35
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.65@3.00
Coke, prompt foundry, per net ton		Connellsville,	3.75@4.50
White lead, dry or in oil,	100 lb. kegs		New York, 13.75
Red lead, dry	100 lb. kegs		New York, 13.75
Red lead, in oil	100 lb. kegs		New York, 15.25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1¼ and 1½ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in, incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb.	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia.	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.

*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Ala., Rockwood — Rockwood Alabama Stone Co.—10 and 30 ton electric cranes for proposed 2 story, 160 x 400 ft. mill and shop. Estimated cost $125,000.

Ind., Anderson — Delco-Remy Corp. of General Motors Corp., C. E. Wilson, Gen. Mgr.—machinery and equipment for proposed 150 x 180 ft. foundry. Total estimated cost $800,000.

Ky., Lawrenceburg—W. C. Morni, Southern Railway—prices and catalogs for socket wrench sets to fit ¾, 1, 1¼ and 1½ in. United States Standard bolt nuts, such as, nuts on frog bolts of Standard railroad frogs, hexagon square.

Mass., Arlington (Boston P. O.)—H. F. Williams, 12 Windsor St.—wood turning lathe, with hand feed, 8 to 10 ft. bed 18 in. swing.

Mass., Charlestown (Boston P. O.)—A. J. Wilson, 33 Miller St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $40,000.

Mass., New Bedford—H. Marcotte, 522 Ashley Rd.—miscellaneous tools and equipment for proposed 1 story, 50 x 100 ft. garage and repair shop on Tarkiln Hill Rd.

Mass., West Quincy (mail Braintree)—Blue Hill Filling Station, 1230 Furnace Brook Parkway—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $40,000.

Mich., Detroit — Dept. of Purchases & Supplies—pipe threading and cutting machine with motor, No. 1.

N. H., Nashua—F. Mumford—8 ft. brake for sheet metal.

O., Cleveland—Carter Machine Co., 983 Front Ave.—square shear, 22 to 30 in.

Tex., Galveston — Acme Machine Co., Inc., W. J. Mead, Pres., Pier A (valves), is receiving bids for lathes, 36 in., milling machine, electric welder, piston ring stock, etc., to cost $18,000.

Ont., Kingston—Dept. of National Defence, Ottawa — mechanical laboratory equipment for plant here.

Que., Montreal — J. Panneton, 335 St. Remi St.—complete machinery and equipment for blacksmith shop also wheelwright work.

Que., St. Lamberts—Monarch Electric Co. Ltd., Waterman St.—(electric fixtures)—machinery and equipment for proposed factory. Estimated cost $75,000.

Australia, Adelaide—Supply & Tenders Board of South Australia, will receive bids until Mar. 14 for one Universal double vertical spindle radius link and hole grinding machine, also until Mar. 21 for two high speed engine lathes, one bull doser machine, three high speed pneumatic hammers and one electrically driven swing grinder.

N. Z., Wellington—Railway Board will receive bids until Apr. 21 for four fuel oil forges, two Root blowers, one stationery hydraulic rivetter, four foundry types self dumping grabs and four platform weighing scales.

Opportunities for Future Business

Ala., Alabama City—Gulf States Steel Co., plans extensions and improvements to plant including finishing mills, etc. Estimated cost $3,000,000. Dwight P. Robinson, 129 East 46th St., New York, N. Y., Engrs.

Arkansas—Dierks Lumber & Coal Co., 1006 Grand Ave., Kansas City, Mo., is having plans prepared for the construction of a lumber mill here. Private plans.

Calif., Berkeley — Bunting Iron Works, 820 Parker Ave., plans the construction of a new plant.

Calif., San Bruno—Western Aero Construction Co., Inc., Jenevein Bldg., plans the construction of a factory for the manufacture of airplanes. Estimated cost $35,000 or $40,000.

Calif., South Pasadena (Pasadena P.O.)—Bd. of Education, will receive bids until Dec. 28 for a 1 story, 320 x 385 ft. high school including shop, etc. Estimated cost $275,000. N. F. Marsh & Co., 1011 Broadway Central Bldg., Archts.

Conn., Guilford—The Johnson Motor Co., Waukegan, Ill., manufacturers of outboard and marine engines, is considering plans for establishing a new plant here.

Conn., Norwalk — E. H. Hotchkiss Co., 6-12 Hoyt St., manufacturers of clips, is having revised plans prepared for a 2 story, 128 x 143 ft. factory. Estimated cost $75,000. Ballinger Co., 105 South 12th St., Philadelphia, Pa., Archt. Former bids rejected. Noted Dec. 1.

Ill., Chicago—Farwell Cornice Co., 3935 Southport Ave., awarded contract for a 2 story, 50 x 125 ft. factory at 2617 Fletcher St. Estimated cost $15,000.

Ill., Chicago—Mechanical Mfg. Co., Union Stock Yards, manufacturers of packing house machinery, awarded contract for a 1 story, 81 x 85 ft. shop. Estimated cost $12,000.

Ill., Schiller Park—Bohnsack Brick Co., 6000 West Grand Blvd., Chicago, is receiving bids for the construction of a plant including 36 x 100 ft. machine shop, etc., at Irving Park Blvd., here. W. Carpenter, c/o owner, Engr.

Ind., Indianapolis—Bd. of School Comrs., will receive bids until Dec. 23 for the construction of a school including woodworking shop, etc. at 57th St. between Central Ave. and Washington Blvd. J. Edwin Kopf & Derry, 620 Indiana Pythian Bldg., Archts.

Ind., Indianapolis—Embassy Realty Co., 540 North Meridian St., is receiving bids for a 3 story, 90 x 140 ft. garage at Pennsylvania and 30th Sts. Estimated cost $150,000. Doeppers & Lennox, 226 East Michigan St. Archts.

Ind., Laporte—The Metal Door & Trim Co. plans addition to factory. Estimated cost $250,000.

Ind., Newcastle — Chrysler Motor Corp., Highland Park, Mich., plans the construction of a 100 x 300 ft. die manufacturing plant here.

Me., Bath—Lewiston Buick Co., C. L. Curtis, Mgr., awarded contract for a 1 story, 65 x 125 ft. garage and repair shop on Commercial St.

Me., Portland—Winslow & Co. Inc., Forest Ave. manufacturers of machinery, awarded contract for the reconstruction of 4 story factory recently destroyed by fire. Estimated cost $250,000. Noted Dec. 1.

Mass., Boston—The Edison Electric & Illuminating Co., 39 Boylston St., is having plans prepared for a 1 story, 120 x 120 ft. garage and repair shop at 1165 Massachusetts Ave. Bigelow & Wadsworth, 3 Hamilton Pl., Archts.

Mass., Cambridge (Boston P. O.)—Auto Windshield Garage, H. H. White, University Rd., awarded contract for a 2 story repair and service garage at 25-31 University Rd. Noted Dec. 15.

Mass., Worcester—Demers Bros. Co., 91 Grafton St., will soon receive bids for a 1 story, 100 x 100 ft. repair and service garage at Green and Grafton Sts. Estimated cost $50,000. J. Rustigian, 16 Norwich St., Archt.

Mo., Kansas City—Standard Oil Co., 5301 East 9th St., plans the construction of a 2 story, 140 x 140 ft. garage and storage house at 20th and Harrison Sts. Estimated cost $150,000.

Mo., St. Louis—Union Cooperage Co., Second and Penrose Sts., awarded contract for a 2 story, 80 x 115 ft. addition to cooperage plant. Estimated cost $550,000.

N. M., Deming— Peru Mining Co., subsidiary of Illinois Zinc Co., 332 South Michigan Ave., Chicago, Ill., plans the construction of an ore mill here. Estimated cost $200,000.

N. Y., Harrison—Intertype Corp., 1440 Broadway, New York, abandoned project for a 1 story, 349 x 620 ft. factory here. Noted Oct. 20.

N. Y., New York—Kent Garage Investing Corp., M. A. Kent, Pres., 209-211 East 43rd St., plans the construction of a 24 story garage. Private plans. Work will be done under the supervision of Fred T. Ley Co., 578 Madison Ave.

N. Y., Rochester — Shoen Bros., 68 Genesee St., plans the construction of a garage at 408 Brown St. Estimated cost $40,000. Foote & Carpenter, Baptist Temple Bldg., Archts.

N. Y., Yonkers—Bd. of Education, South Broadway, had plans prepared for a 2 story addition to Saunders Trade School. Estimated cost $492,937. G. H. Chamberlin, 18 South Broadway, Archt.

O., Cleveland — Forest City-Wolworth Run Foundries Co., c/o P. Schmidt, 4500 Euclid Ave., Archt., had plans prepared for a 2 story, 82 x 100 ft. foundry at West 27th St. and Swift Ave. Estimated cost $50,000.

O., Cleveland—The Packard Motor Car Co., 1580 East Grand Blvd., Detroit, Mich., had plans prepared for a 1 and 2 story, 115 x 181 ft. sales and service station at East 93rd St. and Carnegie Ave., here. Estimated cost $200,000. A. Kahn, Inc., Marquette Bldg., Detroit, Mich., Archt.

O., Dayton—Master Electric Co., Linden Ave., will soon receive bids for a 3 or 4 story factory. Estimated cost $200,000.

O., Steubenville—Wheeling Steel Corp. plans the construction of a new strip mill. Estimated cost $500,000.

Tenn., Knoxville—City plans the construction of a municipal airport at Dickensons Island. Estimated cost $170,000.

Tex., Arlington — Southern Ornamental Iron Works, c/o T. C. Anderson, V. Pres., will soon receive bids for a 1 and 2 story, 100 x 317 ft. factory on Cooper St. Estimated cost $60,000.

Tex., San Angelo—Atchison, Topeka & Santa Fe Ry. Co., 80 East Jackson Blvd., Chicago, Ill., is having preliminary plans prepared for the construction of a roundhouse, etc. here. C. F. W. Felt, Ch. Engr.

Wis., Two Rivers—Aluminum Goods Mfg. Co., G. Vits, Pres., 1500 Franklin St., Manitowoc, is having preliminary plans prepared for a 7 story addition to factory here. Estimated cost $450,000. Lockwood, Greene & Co., 400 North Michigan Ave., Chicago, Ill., Archts. and Engrs.

Ont., Ottawa — Dept. of Public Works plans the construction of an assembly plant and airport.

Ont., Toronto—Artcraft Top & Trimmings Co. Ltd., 9 Bloor St. E., plans the construction of a 2 story, 66 x 158 ft. factory. Estimated cost $35,000.

Ont., Toronto—Syndicate, c/o H. F. Williams, King Edward Hotel, is having plans prepared for the construction of a group of buildings, a 2 story addition to garage and office, etc. Estimated cost $11,000,000. E. L. Sheppard, 57 Queen St. W., and C. B. Dolphin, 10 Leader Lane, Archts.